

NASA Contractor Report 3922(03)

NASA-CR-3922(03)
19860009479

USSR Space Life Sciences Digest

Issue 3

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NASA Contractor Report 3922(03)

USSR Space Life Sciences Digest

Issue 3

Edited by

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*Management and Technical Services Company
Washington, D.C.*

Prepared for
NASA Office of Space Science and Applications
under Contract NASW-3676



National Aeronautics
and Space Administration

**Scientific and Technical
Information Branch**

1985

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To our readers: We are working in a large number of highly technical, specialized areas for which adequate Russian-English glossaries have yet to be compiled. We ask your help in improving the accuracy and specificity of our English terminology. Please fill out the form below whenever you encounter an incomprehensible, incongruous, awkward or otherwise inappropriate term. While we solicit all suggestions for improved renderings, the statement that a term is inappropriate provides us with useful information, even when no better alternative can be suggested. A copy of this form will appear in all future issues of the Digest. Thank you for your help.

Abstract #	Incorrect or contextually inappropriate word or phrase:	Suggested rendering: ("??" is an acceptable entry)

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FROM THE EDITORS

This is the third issue of the USSR Space Life Sciences Digest. In putting together this issue, we have been able to refer to approximately 90 completed reader surveys filled out on the basis of the first issue of the Digest. These surveys suggest that reader evaluation of the idea, subject matter, features and readability of the first issue was generally high. On this basis we have retained all features. Readers voicing most dissatisfaction with the topics covered in the Digest were those whose major interests lie in the areas of exobiology, biospherics, biochemistry, crew diagnosis and health care, and plant response to space conditions. We are continuing our active search for additional Russian materials in these areas and readers are asked to bear with us as we gradually increase the scope of our sources. Reader responses have confirmed our decision to increase the length and level of detail of our periodical article abstracts and to include as many of the clearer and more informative figures as possible; starting with this issue, we will be including all figures and tables from articles describing space flight experiments. More than three quarters of the readers returning surveys made no criticism of the readability of Issue #1 of the Digest, while the others referred to minor problems with technical terms. However, we have received very few specific suggestions for improved terminology, all of which have been incorporated in our lexicon. Readers' attention is again called to the "Feedback Form" included in each Digest issue. We always welcome suggestions for improving our renderings of technical terms. If any reader would like to complete a survey but does not have one available, please write to us.

Several of our readers have communicated with us requesting information about how to obtain translations of Russian materials cited in the Digest. Accordingly, we have increased the specificity of information regarding ordering of JPRS materials from NTIS. These ordering instructions appear on page 87 of this issue of the Digest. Starting on page 90 is a list of titles of monographs in the Soviet series "Problems of Space Biology" which have been translated by NASA and which can be obtained from NTIS. As we become aware of them we will publish complete ordering information about translations of Soviet space life sciences materials available to the public. Members of U.S. Government agencies and NASA and other government contractors and grantees may registers with NASA to receive NASA information products and services. These may include copies of NASA commissioned translations not available to the general public. Organizations or individuals who may be eligible to receive various classes of NASA publications and services should address their requests for registration of further information to:

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B.W.I. Airport, Maryland 21240.

Another excellent source of translations of Soviet material is the National Translation Center. Translations of material abstracted or listed here and not available from NTIS may well be available from them, although, in some cases, not until several months after our Digest is published. There is a \$5.00 inquiry fee, which will be waived for NASA employees and PI's. Translations cost \$15.00 for the first 10 pages and \$3.00 for each subsequent 10 pages. The address and phone number of the Center are:

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University of Chicago
5730 South Ellis Avenue
Chicago IL, 60637
(312) 962-7060

A common concept used in the Soviet space life sciences literature, which may not be familiar to our readers is physical work capacity. Unless otherwise specified, this concept appears to be operationally identified with the parameter of PWC_{170} . In turn, PWC_{170} is defined as follows:

$$PWC_{170} = N_1 + (N_2 - N_1) \cdot \frac{170 - f_1}{f_2 - f_1},$$

where N_1 and N_2 are the loads on a bicycle ergometer and f_1 and f_2 are the corresponding heart rates.

PERIODICALS

ADAPTATION

(See Cardiovascular and Respiratory Systems: P93; Metabolism P127)

BODY FLUIDS

P122(10/85)* Yunusov MA, Orlov VN, Vinokhodova TV. The effect of "dry" immersion on indicators of fluid-electrolyte exchange and levels of aldosterone and hydrocortisone in the blood plasma of individuals with varying levels of total body water. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(4):42-45; 1985. [13 references; 6 in English] Affiliation: Not available.

Body Fluids, Fluid-electrolyte Exchange, Aldosterone
Humans, Edema
Hypokinesia, Immersion

Abstract: This study investigated the effects of immersion on indicators of fluid-electrolyte exchange and levels of aldosterone and hydrocortisone in the blood of two groups of subjects. The first group (N=12) consisted of healthy individuals with normal levels of total body water. This group underwent a continuous 7-day period of "dry" immersion. [In dry immersion, subjects are protected from direct contact with water by being wrapped in a rubber sheet.] Members of the second group exhibited diseases leading to edema (ischemic heart disease, hypertension, and cirrhosis of the liver) and were undergoing 4- to 6-hour sessions of "dry" immersion as part of their treatment. To minimize effects attributable to other factors in the treatment of the second group, all subjects were put on an identical medical regimen during immersion, and for 5-day control periods preceding and following immersion. In the first group, indicators of diuresis, and Na^+ and K^+ concentration in the urine were measured previous to and in the first 3 days of immersion. Hydrocortisone and aldosterone concentration in the blood were measured for this group prior to immersion, 15 minutes, 3 and 7 hours, and 7 days into the immersion treatment, and post immersion. In the second group, fluid-electrolyte indicators were measured in the control period, on the day of immersion and two days afterward. Blood was taken and tested for aldosterone (but not hydrocortisone) before immersion, 2-3 and 4-5 hours into the immersion period and 20 hours after the completion of an immersion session. For the normal group, the immersion treatment increased diuresis and electrolyte excretion, which peaked in the second day of immersion. Aldosterone concentration had dropped by 32 percent by the third hour of immersion, then gradually increased while remaining below the baseline level by the seventh day. One day after immersion, aldosterone concentration slightly exceeded baseline level for this group. Hydrocortisone concentration had also dropped on the third and seventh hour of immersion (but not to a statistically significant extent), and showed a significant increase (by 32 percent) in the seventh day. After immersion, hydrocortisone concentration had returned to baseline level in the first day for the normal group. In

the group of patients with edema, short term periods of immersion increased diuresis and electrolyte excretion, and this effect continued into the second and even third day following the treatment. Short immersion treatments decreased blood plasma levels of aldosterone which were previously above normal levels for these patients. Aldosterone levels continued to be lower than the baseline after 20 hours. (Note that in healthy subjects with normal total body water, effects of immersion on aldosterone disappeared within the first few hours after treatment stops.) The authors conclude that reactions to reduced gravity (immersion) is similar for normal subjects and patients with edema. However, the fact that increased diuresis continues longer after immersion for these patients is interpreted as indicating that there is inertia in the mechanisms regulating fluid-electrolyte exchange upon return to increased gravity. This may indicate that the hemodynamic changes which occur during immersion are not the only factors responsible for elimination of fluids and electrolytes.

Table Titles:

Table 1

Changes in daily diuresis and electrolyte excretion during the first 3 days of immersion in individuals with normal total body water (n=6)

Indicator	Baseline	Immersion Day #		
		1	2	3
Diuresis, ml/min	0.77(0.02)	1.24(0.14)***	1.22(0.1)**	0.86(0.09)
Na, m-equiv/min	160.1(12.3)	255.0(24.3)***	245.0(24.2)****	175.0(22.5)
K, m-equiv/min	46.05(3.1)	51.5(5.6)	57.2(6.45)	49.2(4.7)

* $P < 0.001$; ** $P < 0.01$; *** $P < 0.02$; **** $P < 0.05$; t tests
significance levels

Table 2: Changes in aldosterone and cortisone concentrations in blood plasma of individuals experiencing a 7 day period of "dry" immersion

Table 3: Changes in diuresis and electrolyte excretion in individuals with edema experiencing 4-6 hour "dry" immersion treatments

P132(10/85)* Simonov LG, Rosenblyum LA, Bogdanova NN. Information derivable from echo-signals produced by pulsed ultrasound scanning of the brain (simulation study). Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4):83-85; 1985. [7 references; None in English] Affiliation: Not available

Body Fluids, Intracranial Fluid Shifts
Model, Analogue
Ultrasound Scanning

Abstract: Changes in hydrostatic pressure lead to shifts in intracranial fluid volume ratios which in turn affect intracranial pressure and cerebral blood flow. A noninvasive technique for measuring these ratios is ultrasound impulse location of the walls of the brain ventricle. However, for a number of reasons, this technique is not reliable. This study is devoted to a somewhat different technique for intracranial location in which the ultrasound impulse penetrates the frontal bone of the skull, passes through the brain ventricle and is reflected from the occipital bone. A complex model of the cerebral system was constructed to test this technique. This model included an analogue of blood circulation and a latex model of the brain ventricle which could be filled with varying amounts of water. With this model the analogues of intracranial fluid volumes could be directly altered to test the adequacy of the ultrasound technique for detecting these alterations. In the first series of tests, it was determined that changes in the level of the echo signal reflected from the posterior wall of the skull were associated with changes in the volume of the ventricle. The exact nature of this association depends on the initial dimensions of the ventricle. The second series of tests were performed with the latex ventricle filled with water and submerged in a plexiglass tank. The investigators determined that changes in the acoustic characteristics of the surrounding medium (simulated by adding varying amounts of salt to the water) had substantially greater effects on an echo-signal reflected from the ventricle than on one passing through the ventricle and reflected from the back wall of the tank. These results are described as useful for refining interpretation of human results obtained in vivo.

Figure Titles: Figure 1: Model of blood and fluid dynamics of the human brain and associated apparatus

Figure 2: Relative changes in the level of an echo-signal with changes in acoustic conductivity of the medium

P133(10/85)* Krotov BP, Bazunova YeG, Kulayev BS. Exploration of the potential for using dual frequency impedance plethysmography for determining the ratio between total and extracellular fluids in the body. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4):86-89; 1985. [9 references; 8 in English] Affiliation: Not available

Body Fluids, Total and Extracellular Fluids
Rats
Impedance Plethysmography, Dual Frequency

Abstract: The goal of this study was to explore the possibility of using dual frequency impedance plethysmography for determining the ratio between total fluid and extracellular fluid. When frequencies of 1 and 100 kHz are used, the ratio between respective impedances is approximately 1.30; when frequencies of 5 kHz and 1 MHz are used, this ratio is approximately 1.50. In a healthy human being the ratio of total impedance to extracellular impedance is constant for a given pair of frequencies. Four experiments using rats (sex and age not specified) were performed. In all experiments electrodes were implanted subcutaneously to avoid effects resulting from capacitance resistance of the skin. The first experiment investigated differences in impedance of the upper and lower portions of the body in upright and head-down positions. The next three experiments made use of a catheter through which physiological (saline) solutions or polyglucan were introduced as a means of incrementally increasing extracellular fluid. Experiment 2 measured impedance in the right pleural cavity after fluid had been introduced. In experiment 3 different amounts of fluid were administered through a catheter in the abdominal cavity. Experiment 4 measured impedance in a segment of the abdominal region after fluid had been introduced into the large intestine. Since none of the experimental manipulations lead to changes in the ratio between impedance to current of 1 kHz and impedance to current of 100 kHz, the authors conclude that there is no evidence that two-frequency impedance plethysmography is useful for exploring fluid shifts in the body.

Figure Titles: Figure 1: Impedance of the chest cavity of rats during changes in body orientation

Figure 2: Impedance of the lower half of rats during changes in body orientation

Figure 3: Change in impedance of the lower half of the trunk of rats after introduction of polyglucan into the abdominal cavity

Figure 4: Change in impedance of a segment of the abdominal region of rats after introduction of polyglucan into the rectum

P91(10/85) Semenov VYu, Aleksandrova YeA. Changes in fluid-electrolyte exchange early in an immersion period at different times of day. *Fiziologiya Cheloveka*. 11(3): 499-503; 1985. [23 references; 16 in English] Affiliation: Not available

Body Fluids, Fluid-electrolyte Balance

Humans

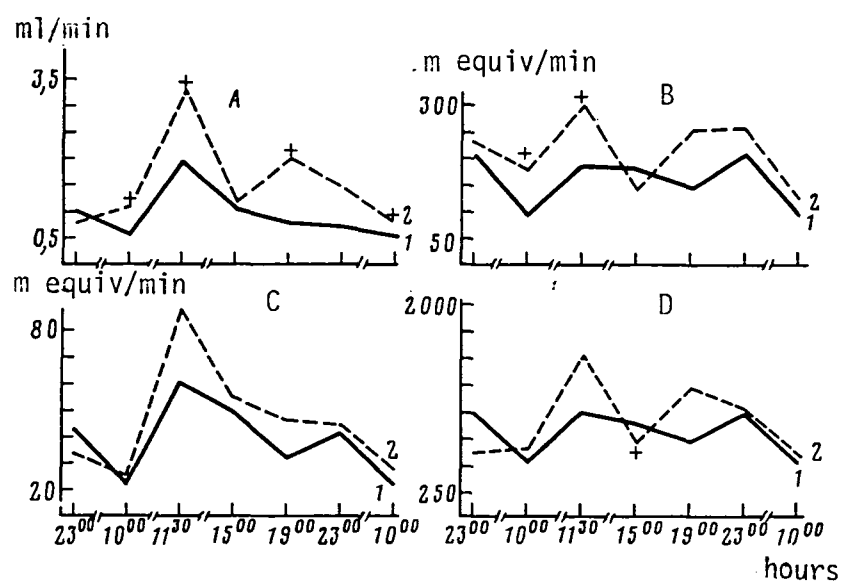
Immersion

Abstract: Fourteen individuals (sex not specified) were studied under conditions of "dry" immersion. (In dry immersion, subjects are protected from direct contact with the water by a thin plastic sheet.) Eight began immersion in the morning and remained immersed for 24 hours; six began immersion in the evening and remained immersed for 36 hours. Venous blood and urine were analyzed. Blood was drawn during the baseline period (previous day) and during immersion. Urine was collected at several intervals during the experiment and was compared to urine samples obtained at the same times on the day preceding the experiment. The subjects were placed on a standard diet throughout the experiment. The concentrations of sodium, potassium, creatinine and osmotically active substances in the blood serum and urine was determined using traditional techniques. The concentration of the hormones (renin, aldosterone, adrenocorticotropin, hydrocortisone, and insulin) in the blood was determined using radioimmunoassay methods. For both experimental groups excretion of fluid and ions remained at baseline level for the first 1.5 hours of immersion. After this lag period, diuresis increased, reaching three to five times its baseline level in the morning hours for the first group. Although diuresis increased during the initial hours of immersion, which occurred during the night for the second group, the maximum diuresis for the second group occurred during the morning hours. Excretion of sodium and osmotically active substances followed the same pattern as fluid excretion for both groups. Diurnal patterns of potassium excretion remained virtually unchanged for both groups. Glomerular filtration rate, as measured by clearance of creatinine, appeared unchanged by the first 1.5 hours of immersion for all experimental subjects. The concentrations of insulin and renin in the blood increased significantly 1.5 hours after beginning of immersion, (i.e., in the morning hours) for the first group. Comparable insulin and renin data was not obtained for the early period of immersion for the second group.

Table and Figure Titles: Table 1: Rate of urinary excretion of fluids, sodium, potassium, and osmotically active substances, and clearance of creatinine before and after immersion for the Group 1

Table 2: Concentration of hormones in the blood before and during immersion for the Groups 1 and 2

P91



FIGURE

Renal excretion of fluid, electrolytes and osmotically active substances before (1) and during (2) 6 hours of immersion

Abscissa: time of day in hours; Ordinate: excretion rate of fluids in ml/min (A); sodium (B) and potassium (C), in micro Eq/min; osmotically active substances, in micro Osm/min (D)

P92(10/85)Monin YuG, Goncharevskaya OA, Izmaylova NP, Mlodik YeYa. The effect of various low-calorie diets on fluid-electrolyte homeostasis. Fiziologiya Cheloveka. 11(3): 511-521; 1985. [17 references; 6 in English] Affiliation: I.M. Sechenov Institute for Evolutionary Physiology and Biochemistry, USSR Academy of Sciences, Leningrad

Body Fluids, Fluid-electrolyte Balance
Humans, Males
Nutrition, Diets, Low Calorie

Abstract: Twenty-three healthy males, aged 20-35, participated in this 25-day experiment. The first 5 day period was a control period during which the subjects were fed a normal 2900 kcal diet; the last five days were a recovery period during which the subjects' diet was gradually increased back to a normal level. During the entire 25 day period subjects performed work equivalent to approximately 2800 kcal and received unlimited water. For the experimental 15 day period, half the subjects were placed on a carbohydrate-fat diet and half on a protein-fat diet. Within each of these groups were two subgroups varying in total amount of calories consumed. Group A consumed 40 g fat and 80 g carbohydrate; Group B consumed 40 g fat and 250 g carbohydrate; Group C consumed 40 g fat and 80 g protein; Group D consumed 40 g fat, 80 g protein and 170 g carbohydrates. Groups B and D consumed 1400 kcal and Groups A and C consumed 700 kcal. Minerals and vitamins were administered to all groups at a constant level. Blood and urine samples were taken at the end of the control period, twice during the experiment and at the end of the recovery period. Concentration of Na^+ , K^+ , Ca^{++} , Mg^{++} , Cl^- , urea, and endogenous creatinine were determined for these samples. Results can be summarized as follows. For subjects in all of the low-calorie groups, electrolyte balance was maintained at a stable level in comparison to the concentration of osmotically active substances in the blood. Reduced calorie diets led to a reduced osmotic index for the carbohydrate diet and an increased osmotic index for the protein diet; increase in the osmolarity of the blood serum was accompanied by a reduced concentration of sodium. Reduced calorie diets resulted in a decrease in the excretion of electrolytes through the kidneys and skin; an increase in the reabsorption of osmotically active substances occurred immediately after the change in diet. Reabsorption of "osmotically free fluid" [fluid containing no osmotically active substances] decreased for both groups. For the group receiving the carbohydrate diet, this effect was positively correlated with osmolarity of blood plasma; for the group receiving the protein diet, these two factors were negatively correlated.

Table Titles: Table 1: Blood composition of subjects on a 700 calorie diet

Table 2: Blood composition of subjects on a 1400 calorie diet

Table 3: Parameters of the osmo- and ionregulating renal functions in subjects on a 700 calorie diet

Table 4: Parameters of the osmo- and ionregulating renal functions in subjects on a 1400 calorie diet

BOTANY

(See LIFE SUPPORT SYSTEMS: P129; RADIOBIOLOGY: P115)

CARDIOVASCULAR AND RESPIRATORY SYSTEMS

(See also ENDOCRINOLOGY: P106)

P131(10/85)* Bryantsev LA, Mikhenko AYe. Evaluation of human physical work capacity under hyperbaric conditions. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(4):11-19; 1985. [84 references; 47 in English] Affiliation: None available

Cardiovascular and Respiratory Systems, Physical Work Capacity
Humans, Divers
Hyperbaria

Abstract: The subject of this literature review is the effects of hyperbaric environments, such as are encountered by divers, on human physical work capacity, which is known to decrease as a function of immersion depth. Physiologically, the factors which limit work capacity include: increased pulmonary resistance, a decrease in the maximum velocity of the air stream, higher energy cost of ventilation, CO₂ retention and respiratory acidosis, and labored breathing. The authors attribute some of the paradoxical results in the literature (e.g., that on occasion VO₂ max during physical labor under high pressure has been lower than during analogous work performed at normal pressure), to the possible occurrence of a compensatory shift to a more efficient breathing pattern. Although substantial amounts of data exists to indicate that hyperbaric conditions lead to adverse hemodynamic effects, the authors agree with the hypothesis that circulatory factors do not contribute substantially to limiting the work capacity of divers. According to the authors, the most commonly used measure of work capacity, PWC₁₇₀, depends on a linear relationship between heart rate and VO₂ max (as an index of work performed). However, because of hyperbaric bradycardia, this measure is not appropriate under conditions of increased pressure. The most promising basis on which to estimate the maximum work load an individual can tolerate at a given depth, according to the authors, is maximum oxygen consumption. However, measurement of this parameter may be difficult or even impossible in actual diving situations. Use of this and other measurements indicate that maximum work capacity is reduced under hyperbaric conditions. The amount and duration of work should be limited at depths as shallow as 490-610 m, while at rest it is believed that humans can breathe helium oxygen mixtures at depths of up to 1500 m. The authors suggest that more research is needed on the following topics: role of fatigue of the respiratory musculature in a dense medium; the effect of hyperoxia and adaptation to hyperbaric conditions on work capacity; the role of the central nervous system; and how the effects of high partial pressure of inert gases and heat exchange contribute to the effects of hyperbaria.

Table Title: Amount of work performed by divers under various pressures in a helium-oxygen mixture

P119(10/85)* Vol'vach SI, Kovalenko YeA, Voronin LI, Ulyatovskiy NV, Gabyshev VK, Nikiforov VI, Arkhipov VV. Oxygen balance and regional circulation in the gingival mucosa during exposure to positive $+G_z$ acceleration in the head-pelvis direction. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 31-35; 1985. [4 references; none in English] Affiliation: Not available

Cardiovascular and Respiratory Systems, Impedance Plethysmography,
Polarography
Humans, Males
Acceleration Stress, Countermeasures

Abstract: This investigation used a new noninvasive polarographic device for performing impedance plethysmography. This device consisted of a sensor in two sections. Each section contained a contact polarographic electrode with platinum contacts and a pair of impedance plethysmography electrodes, one for carrying current and one for performing measurements. Thus, the device made it possible to record pO_2 and perform impedance plethysmography at four points simultaneously. The device was used to monitor oxygen balance and regional circulation in the gingival mucosa of 5 healthy males who were undergoing exposure to levels of $+G_z$ acceleration in the head-pelvis direction reaching $+4.5 G_z$ on a centrifuge. In addition, EKG, heart rate, blood pressure, respiration rate and electromyographic data were recorded before during and after the acceleration sessions, as was reaction time to light. Acceleration was terminated when the subject appeared to reach his tolerance limit. This was operationally identified as the point of peripheral vision loss, a grey out, voluntary muscular relaxation and blood pressure drop to below 40 mm Hg in the vessels of the external ear. Three acceleration sessions were conducted. In the first series of sessions, tolerance enhancing measures were not used; in the second series, pharmacological countermeasures were administered; in the third series, an anti-G suit was used. Data was analyzed using Wilcoxon-Mann-Whitney nonparametric tests and Spearman correlations. A high positive correlation (.85) was found between pO_2 and blood pressure in the external ear, and a moderate correlation (.58) between the latter and an unspecified parameter derived from impedance plethysmography data. In all the sessions, immediately before centrifugation had to be terminated a sharp drop in pO_2 was observed, accompanied by a drop in the plethysmographic index. The authors suggest that this index could be used as a predictive indicator of tolerance to acceleration. If pO_2 drops sharply and there is no compensatory increase in the value of the index when rotation begins, then tolerance is predicted to be poor. However, if a compensatory increase does occur, this is likely to be associated with good tolerance. Results also indicated that a clear relationship exists between blood supply to the gingival mucosa and changes in blood pressure measured in the arteries of the shoulder. This relationship is particularly evident when prophylactic measures are administered. These measures increased acceleration tolerance significantly but did not qualitatively alter the pattern of results.

Figure Titles: Figure 1: Changes in pO_2 in the gingival mucosa during exposure to acceleration applied in the head-pelvis direction

P119

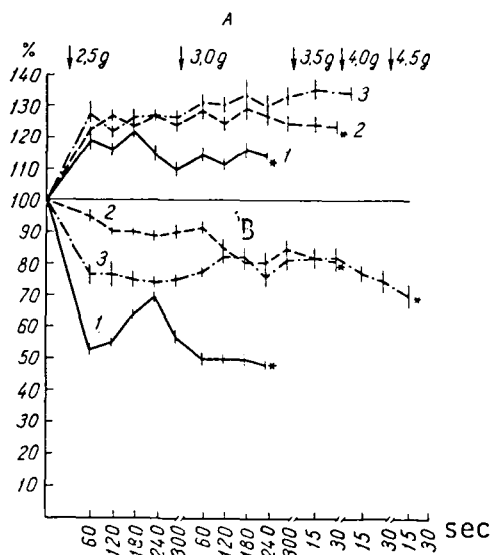


Figure 2

Changes in blood pressure and impedance plethysmographic index in the tissues of the gingival mucosa during exposure to acceleration applied in the head-pelvis direction

Abscissa: time in seconds; Ordinate: deviation (in %) from initial value. Stars designate points where rotation was stopped.

Figure 3: Changes in pO_2 in the gingival mucosa in subject Zh. during exposure to acceleration applied in the head-pelvis direction

P134(10/85)* Sokolova IV, Khrashcheva LA. Automated measurement of cardiac output by means of impedance plethysmography of the trunk. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4):89-90; 1985. [2 references; none in English] Affiliation: Not available

Cardiovascular and Respiratory System, Cardiac Output, Impedance Plethysmography

Human

Biomedical Data Processing and Cybernetics, Automated Program;

Abstract: This paper describes the use of a Fortran IV program for determining various cardiac output parameters on the basis of data from impedance plethysmography of the trunk. The program can perform the following functions: separation of cardiographic wave signal from noise, identification of the structural elements of the cardiographic wave for a single cycle, computation of parameters of cardiac output for a single cycle averaging of these cardiac output parameters over a time interval and computation of the confidence limits for a given level of significance.

P126(10/85)* Katkov AYU, Vyazova YeP, Chabdarova RN, Krikun IS, Kudryashova ZhM. Tolerance to sudden onset hypoxic hypoxia in humans. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 57-60; 1985. [10 references; None in English] Affiliation: None available.

Cardiovascular and Respiratory Systems

Humans, Typology

Hypoxia, Rapid Onset

Abstract: This study investigated the effects of sudden onset hypoxic hypoxia, such as develops when an aircraft cabin depressurizes rapidly. This situation was simulated by the breathing of nitrogen. Forty-five subjects breathed nitrogen until they were unable to perform a simple writing test. Throughout the session heart rate, respiratory minute volume, and gas exchange parameters were monitored continuously and electroencephalographic and pneumographic recordings were made. While subjects were breathing nitrogen, alveolar PO_2 and the PO_2 of venous blood were also monitored. In addition, pH and CO_2 loading, and oxygen saturation in venous blood were determined. Blood was taken before, during and 5 minutes after the session. The vessels of the fundus of the eye were monitored as an indicator of treatment effects on the cerebral vasculature. Subjects were divided into two groups according to their reaction to hypoxia. The first group had an average time to unconsciousness (defined as the point at which subjects were unable to write) of 55 seconds; the second group's average time was 80 seconds. At the moment that they became unable to write, all subjects showed an increase in slow wave EEG activity. Subjects in the second group, i.e., those with longer times to unconsciousness, showed less pronounced reactions in pulmonary ventilation and O_2 expiration than those in the first group. An index of deoxygenation computed from used and expired O_2 (corrected for time spent breathing nitrogen) equalled 1062 ml O_2 for Group 1, and 1276 ml for Group 2. These values are interpreted as indicating the subjects lost between 44 and 52% of their oxygen reserves while breathing nitrogen. At the point of losing consciousness all subjects demonstrated lower pO_2 in alveolar air than in venous blood. At the point of losing consciousness, subjects' retinas showed engorgement and pronounced vasodilation, which had not returned to normal 5 minutes after air breathing was resumed. Oxygen saturation of venous blood continued to drop after termination of nitrogen breathing as a result of oxygen debt. Saturation of arterial blood had dropped to 60-65% of baseline level when nitrogen breathing terminated and then quickly returned to baseline level.

Table and Figure Titles: Table 1: Reactions of the human cardiovascular and respiratory systems to the breathing of nitrogen as a function of time to unconsciousness

Table 2: The effect of breathing nitrogen on oxygen conditions in humans

Figure: Time course of replacement of oxygen by nitrogen in alveolar air measured with a radiofrequency mass spectrograph during breathing of oxygen by humans

P97(10/85) Bunyatyan AM, Mar'yan KL, Kargina-Terent'yeva. Changes in cardiovascular functions and adrenergic cardiac innervation in response to immobilization stress. *Fiziologicheskii Zhurnal SSSR imeni I.M. Sechenova*. LXXI(5):581-586; 1985. [12 references; 3 in English] Affiliation: L.S. Ul'yaninskiy Laboratory of Experimental Cardiology of the P.K. Anokhin Scientific-Research Institute for Normal Physiology of the USSR Academy of Medicine; V.N. Zhvalev Laboratory for Neurohistology and Histochemistry VKNTs of the USSR Academy of Medicine.

Cardiovascular and Respiratory Systems, Innervation; Also
Endocrinology, Adrenal Gland
Rats, Typology
Immobilization Stress

Abstract: Forty rats (aged 2-3 months, 20 Wistar and 20 August) were subjected to 30 hours of immobilization in a chamber which severely restricted movement. EKG, arterial pressure and breathing were monitored. The animals were dissected after termination of immobilization or, for animals expiring during the experiment, directly after death. Sections of the right atrium, the anterior wall of the left ventricle and the adrenal gland were removed for histologic study. The density and distribution of adrenergic nerve terminals in the myocardium was assessed. The rats could be classified on the basis of their EKGs and arterial pressure under immobilization into three groups: tolerant, adapting, and predisposed to emotional stress. Tolerant animals showed no substantial changes in the parameters measured during immobilization. Adapting animals showed substantial fluctuations in these parameters during immobilization. For animals in both of these groups the density of adrenergic terminals in the myocardium and the intensity of their luminescence (indicating depletion of the catecholamines) decreased both in the right atrium and in the left ventricle, but to a more pronounced extent in the latter. The third group of animals, those identified as predisposed to stress, died during immobilization. The major cause of death was a progressive decrease in arterial pressure culminating in a precipitous drop. Disruptions of heart rhythm were also noted in these animals before death. These animals demonstrated the most marked decrease in the density of adrenergic terminals in the myocardium. The adrenal glands of all the immobilized animals showed depletion in the concentration of catecholamines in the chromaffin cells. However, this change was minimal for the animals in the tolerant and adapting groups and much more pronounced for those in the emotionally stressed group. Additionally, the third group demonstrated sharp increases in the width of sinusoidal capillaries leading to rupture of the adrenal endotelium and diffusion of small granules of catecholamines into the resulting lacunae. This experiment indicates that animals demonstrating different degrees of tolerance to immobilization stress also differ in the degree of disruption of cardiovascular functions and adrenergic innervation of the heart. Rats of the Wistar and August strains showed a differential likelihood of belonging to the different groups, with the Wistar rats being more tolerant of stress, and therefore differing degrees of cardiovascular change, even though no differences in cardiac parameters are manifested under non-stressful conditions.

Figure Titles: Figure 1: EKG, blood pressure and respiration in rats tolerant of immobilization stress

Figure 2: EKG, blood pressure and respiration in rats which died during immobilization stress

Figure 3: Changes in adrenergic innervation of the myocardium of the left ventricle of rats in response to immobilization stress

P94(10/85) Vinogradov AV, Sycheva Im, Rylova AK. Clinical value of using scintigraphy with ⁹⁹Tm-pyrophosphate in conjunction with a bicycle ergometric exercise test. Kardiologiya. XXV(5): 9-14; 1985. [22 references: 16 in English] Affiliation: Department of Pediatrics II, N.I. Pirogov MMI [Moscow Medical Institute]

Cardiovascular and Respiratory Systems, Myocardium; Also Health and Medical Treatment
Patients, Heart Disease
Scintigraphy

Abstract: Accumulation of pyrophosphate in the myocardium is one indicator of irreversible metabolic disorders associated with cardiac ischemia. This condition can be identified by using pyrophosphate marked with ⁹⁹Tm. The authors hypothesize that this technique would be useful in identifying individuals suffering from chronic ischemic heart disease who are most at risk of further complications or attacks. Thirty-eight patients were subjects in this experiment, 21 were in the early stages of recovery from myocardial infarction and 17 exhibited angina with no history of myocardial infarction. All subjects were given an exercise test on a bicycle ergometer. Testing with radiolabeled pyrophosphate was performed the day before the exercise test, during the most strenuous part of the test and on the next day. Accumulation of pyrophosphate was assessed using a rating scale. Subjects' clinical histories were followed for one year subsequent to the experiment. Thirteen different response patterns were identified and interpreted in terms of degree of myocardial damage and blood supply to affected areas, leading to risk prediction of further complications or attacks. These predictions were confirmed for 93.2 percent of the patients with angina and 83.3 percent of the patients who had exhibited infarction (87.9 percent overall).

Table Title: Changes in myocardial metabolism using ⁹⁹Tm-pyrophosphate before, during and after exercise.

P93(10/85) Meyerson FZ, Dolgikh VT, Smolentseva VN, Batrachenko YeR. Prevention of metabolic disorders and impairment of heart muscle functioning in response to immobilization by means of preliminary adaptation to short periods of stress. Voprosy Meditsinskoy Khimii. 31(3): 41-45: 1985. [16 references; 5 in English] Affiliation: Institute for General Pathology and Pathological Physiology, USSR Academy of Medicine and Omsk Medical Institute

Cardiovascular and Respiratory Systems, Myocardia; Also Adaptation
Rats
Stress, Immobilization; Pre-adaptation

Abstract: Ninety-two outbred rats weighing 185-200 g, divided into four groups, served as subjects in this experiment. Group 1 was the control; animals in Group 2 were immobilized on their backs for a 6 hour period; animals in Group 3 were subjected to one hour preadaptive periods of immobilization stress for 15 consecutive days; animals in Group 4 underwent the same treatment as Group 3, followed by the 6-hour period of immobilization used for Group 2. The hearts of half the animals in each group were used for study of the contractile function of the left ventricle, while the hearts of the other half were used for chemical analysis of the myocardium. Chemical analysis of the myocardium indicated that the concentration of creatinine phosphate, malate dehydrogenase, and ribonuclease, were 1.5 - 2 times higher in the blood of rats in Group 2 than in blood of the control rats. Concentration of these enzymes in animals subjected to the preadaptation treatment alone (Group 3) did not differ from those of the controls. Enzyme concentration in the blood of animals in Group 4 (preadaptation followed by 6 hours of stress) were significantly (Student's t) higher than that of the control animals, but substantially lower than that of the Group 2 animals subjected to acute stress without preadaptation. Analysis of the left ventricle contractile function indicated a similar pattern of results: preadaptation to short periods of immobilization eliminated or moderated the adverse effects of exposure to a longer period of acute stress. Since earlier work had shown that increase in lipid peroxidation and decrease in myocardial glycogen contributed significantly to damage to the cardiac myocytes and disruption of contractility, concentration of glycogen and lipid peroxides were measured for all groups. Concentration of these substances in the preadapted stressed animals was intermediate between that of the controls and that of the animals subjected to acute stress alone.

Table Titles: Table 1: Effect of immobilization stress and preadaptation on the concentration of blood serum enzymes

Table 2: Disruption of heart muscle contractility following immobilization stress at various heart rates

Table 3: Effect of stress and adaptation on concentration of enzymes in the coronary arteries of isolated hearts of rats

Table 4: Effect of immobilization stress and adaptation to short periods of stress on concentration of glycogen and lipid peroxidation in rat hearts

ENDOCRINOLOGY

(See also: CARDIOVASCULAR AND RESPIRATORY SYSTEMS: P97;
MUSCULOSKELETAL SYSTEM: P98)

P95(10/85) Belyayev NG. Endocrine regulation of calcium homeostasis in a recovery period. *Teoriya i Praktika Fizicheskoy Kul'tury*. 1984(4): 18-19. [9 references; none in English] Affiliation: Stavropol State Pedagogic Institute

Endocrinology, Thyroid, Parathyroid, Calcium
Humans, Athletes
Physical Exercise

Abstract: The goal of this study was to investigate changes over time in calcitonin activity in blood plasma and in concentration of total calcium during recovery from a strenuous workout on a bicycle ergometer. In addition, changes in inorganic phosphorous were examined as an indirect indicator of the functioning of the parathyroid glands, because of the role of the parathyroid hormone in calcium metabolism. Fourteen highly trained athletes participated in the study. The exercise involved three hours of pedalling a bicycle ergometer at 60 rev/min. Blood was drawn from the subjects before the workout, immediately after it and 1, 6, 24, 48, 72 and 96 hours later. Concentration of calcium and unbound phosphorus were determined; calcitonin activity in the plasma was estimated on the basis of a biological assay with mice. Before the workout all three of these values were within normal range for the subjects. The exercise led to a significant increase in calcitonin activity and a significant decrease in the concentration of calcium. Phosphorus concentration also increased but this was not statistically significant. Calcitonin activity continued to increase during the first hour after exercise and at the end of an hour was twice its baseline level. Calcium and phosphorous concentration did not change in the first hour. Calcitonin activity decreased sharply after 6 hours, increased somewhat after 24 hours and then decreased, again reaching baseline level by 96 hours. Calcium concentration increased to its baseline level by 48 hours, followed by a slight decrease at 72 and another increase to baseline at 96 hours after the workout. Concentration of phosphorous fluctuated slightly, but generally remained slightly above baseline until 96 hours. The authors conclude that concentration of calcium, phosphorous, calcitonin and parathyroid hormone in the blood are useful as indicators of recovery processes after strenuous exercise.

Table and Figure Titles: Table: Changes over time in calcitonin activity, concentration of total calcium and inorganic phosphorous in blood plasma of subjects (n=14) in the recovery period after a bicycle work-out

Figure: Changes over time of level of calcium, calcitonin activity and phosphorous in blood plasma in humans after physical exertion

P106(10/85) Ivanova TM, Kvetanskiy R, Bedova TI, Oprshalova Z, Dobrakovova M. [USSR, Czechoslovakia] Catecholamine content in brain nuclei of August rats subjected to immobilization stress. Fizioloicheskiy Zhurnal SSSR imeni I.M. Sechenova. LXXI(7): 823-828; 1985. [20 references; 13 in English] Affiliation: P.K. Anokhin Institute of Normal Physiology, USSR Academy of Medicine, Moscow; Institute of Experimental Endocrinology, Slovak Academy of Sciences, Bratislava, Czechoslovakia

Endocrinology, Catecholamines; Neurophysiology;
Cardiovascular and Respiratory System, Blood Pressure
Rats, Individual Differences, Typology
Stress, Immobilization

Abstract: Twenty-two male rats of the August line with catheters implanted in their tail arteries were immobilized for 6.5 hours. Each rat's blood pressure had been measured before the beginning of the experiment and was monitored throughout the immobilization period. After the experiment the concentration of epinephrine norepinephrine and dopamine in individual nuclei in 8 areas of the brains was determined using a sensitive radioenzyme method. The brain areas examined included: epinephrine synthesizing areas A_1 and A_2 of the medulla oblongata, the locus ceruleus and n. subceruleus in the norepinephrine synthesizing nuclei of the brain, the A_9 and A_{10} dopamine synthesizing structure of the mid-brain, and the A_{12} and A_{14} areas of the hypothalamus. Brains of control rats not subjected to immobilization were also examined. Multiple t tests were used to estimate the significance of differences observed. Changes in catecholamine content associated with cardiovascular responses to immobilization -- and with individual differences in these responses -- were found in a number of areas. Sharp increases in blood pressure under stress were associated with substantial decreases in epinephrine in area A_1 , norepinephrine in the locus ceruleus (A_6) and dopamine in the substantia nigra A_9 . The authors interpret these results as suggesting that changes in the metabolism of catecholamines in the brain areas examined may be one cause for the observed change in cardiovascular functions under stress.

Table and Figure Titles: Table 1: Concentration of epinephrine in various areas of the brains of August rats in control group and after exposure to immobilization stress

Table 2: Concentration of norepinephrine in various areas of the brains of August rats in control group and after exposure to immobilization stress

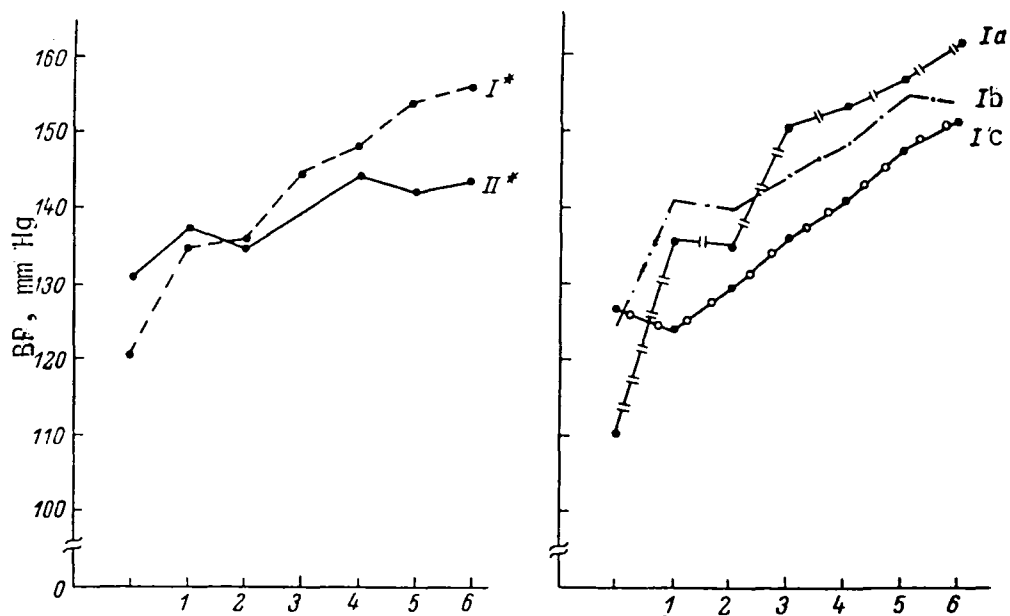
Table 3: Concentration of norepinephrine in various areas of the brains of August rats in control group and after exposure to immobilization stress

P106

FIGURE

Mean values of changes in blood pressure during immobilization in rats categorized as belonging to groups I and II and subgroups Ia, Ib and Ic.

[Rats were subdivided into groups on the basis of blood pressure increases under immobilization.]



Abscissa: Hours of immobilization; Ordinate: Blood pressure, mm Hg;

*: differences between groups I and II significant at $P < 0.05$.

P96(10/85) Makoyeva LD, Belinskaya TF, Li YeD, Margaryan AG, Sabayev VV. The effect of beta-adrenegic blockers and trental on plasma renin and aldosterone concentration in normal subjects during hypokinesia with head-down tilt. *Kardiologiya*. XXV(6):40-42; 1985. [6 references; 4 in English]

Endocrinology, Aldosterone, Renin

Humans, Males

Hypokinesia, Head-down Tilt; Drugs, Beta-blockers

Abstract: This study examined the effects of a number of drugs in preventing the adverse effects of hypokinesia with head-down tilt. Thirty healthy males (25-40 years old) participated in the study. Subjects were exposed to hypokinesia with head-down tilt of -15° for 6 hours. Measurements were taken before the experiment with subjects in a horizontal position, in the third and sixth hour of head-down tilt, and during the recovery period the day after the experiment. Concentrations of aldosterone and plasma renin activity were measured with radioimmunoassay. With no drugs administered, 6 hours of head-down tilt had reduced the aldosterone concentration of subjects to 14 percent below baseline levels. Administration of two different beta-blockers -- "obsidanum" /80 mg/ and "octadinum" /12.5 mg/ -- tended to increase the concentration of aldosterone in head-down tilt, however, this effect was not statistically significant. The head-down tilt led to reliable increases in plasma renin activity in 70 percent of the subjects. Obsidanum significantly decreased plasma renin activity during head-down tilt in 7 of the 10 subjects who had experienced an increase. Octadinum had no significant effect on this parameter during head-down tilt. Neither trental nor menthol prevented the drop in aldosterone concentration associated with head-down tilt, but glycerol did bring this concentration down to that observed in the horizontal position. All three drugs lowered plasma renin activity which had increased in response to head-down tilt; however, only glycerol lowered it to the baseline level. Combinations of the drugs cited above and beta-blockers led to significant decreases in plasma renin activity which had increased in response to head-down tilt. The combinations of drugs, particularly trental and mentol, additionally led to increased aldosterone levels in the head-down position. The authors attribute the effect of the beta-blockers on renin and aldosterone to the inhibition of beta-adrenergic activity.

EXOBIOLOGY

P99(10/85) Lozina-Lozinskiy LK. Where did life originate -- in the ocean or on land? Zhurnal Evolutsionnoy Biokhimii i Fiziologii. XXI(3):303-307; 1985. [15 references; 2 in English] Affiliation: Institute of Cytology, USSR Academy of Sciences, Leningrad

Exobiology, Abiogenesis
Review Article
Anabiosis, Dry Land

Abstract: This review article supports the hypothesis that life on earth originated on dry land and not in the ocean. It is agreed that sources of high energy are a necessary condition for abiogenic synthesis of biopolymers. The author cites solar radiation (which would have reached the earth's surface under conditions of a reducing atmosphere but would have been absorbed by the upper layers of the water) as the most likely high energy source. Other possible sources are intense volcanic activity and electrical charges. Proponents of the dry land theory believe that it was under these conditions that the first life forms (protobionts, protocells) appeared. These organisms would have needed water, which they typically would have been able to obtain on the surface of the earth. The capacity in primitive organisms for anabiosis and hypobiosis (or suspension of development and prolonged cessation of vital activity) in response to desiccation or freezing also suggests that these organisms originated on dry land. This capacity would have facilitated tolerance to radiation and other adverse factors which were undergoing rapid changes in the air-land milieu and reducing atmosphere. If life had originated under the relatively stable conditions in the ocean, primitive organisms would not have required such capacities and would not have been likely to possess them. In the process of evolution, among animals which settled on the land after the oxygen atmosphere had formed, the capacity for anabiosis has been retained only by primitive forms, certain insects, and also by cells of embryos and higher vertebrates.

GRAVITATIONAL BIOLOGY

P125(10/85)* Kotovskaya AR, Krasnov IB, Shipov AA. Major results of experiments with long-term centrifugation of rats as applied to the problem of artificial gravity. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 53-57; [5 references; 1 in English] Affiliation: None available

Gravitational Biology, Physiological Indicators

Rats

Artificial Gravity, Centrifugation, Long-term

Abstract: The experiments described in this paper represent a continuation of the research begun on the "Cosmos-936" biosatellite. These experiments seek to determine the physiological effects of long-term centrifugation on rats. Rats were housed unrestrained in group cages attached to a centrifuge and centrifuged for 21 and 30 days at 1.1 and 2.0 G. Dependent variables examined were: motor activity, changes in body weight and weight of individual organs (adrenal, thymus and thyroid glands), static and dynamic endurance, tolerance of gravitational acceleration ($+G_z$), vestibular function, balance, dimension and contractility of the skeletal muscles, peripheral blood chemistry, bone dynamics, gas exchange, morphometry of the adrenal and thyroid glands, and cortex of the cerebellum nodulus, biochemical analysis of hormones in the blood, enzyme activity in the liver, alkaline phosphatase in bone tissue, myosin Ca^{++} - Mg^{++} -ATPase in the myocardium, and protein sulfhydryl groups in the motor cortex. Thirty or 21 days of centrifugation at a level close to 1-g, either did not alter the physiological indicators measured in the rats or altered them only slightly to a non-statistically significant extent. Rats centrifuged at a level corresponding to 2-g demonstrated changes in a number of systems (particularly the myocardium and musculoskeletal system), indicating heightened activity. No evidence was found that long-term centrifugation had deleterious effects on physiological function. The fact that equilibrium, endurance, and skeletal muscle contractility were not adversely affected by the centrifugation led the authors to conclude that such adverse reactions by animals on "Cosmos-936" were due to the immobilization cages used, and not to the artificial gravity.

HABITABILITY AND ENVIRONMENTAL EFFECTS

P138 Novikova ND, Zaloguyev SN. The formation of volatile matter in the process of polymer decomposition by Pseudomonas aeruginosa. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(4):74-76; 1985. [10 references; 1 in English] Affiliation: None available.

Habitability and Environmental Effects, Artificial Atmospheres
Microbes, Pseudomonas aeruginosa
Outgas, Polymers

Abstract: Many natural polymers are readily biodegradable, forming amino acids which in turn give off ammonia and volatile organic acids. The potential toxicity of such by-products is particularly relevant in the design of living quarters using artificial atmospheres, particularly in spacecraft. Changes in the intensity and nature of gases emitted by polymer materials as a result of microbial degradation may substantially affect living conditions. The goal of this study was to investigate the gases emitted by the most widely used polymer materials, particularly epoxide resins, when Pseudomonas aeruginosa microorganisms multiplied on them. Samples of the polymers to be tested were placed in a vacuum desiccator. Condensate of atmospheric moisture (obtained in an earlier experiment involving human habitation of a hermetically sealed living space) and a suspension containing the microbes being studied were added. As controls, identical containers were filled with: 1) material sample and condensate without microbes; 2) material sample and distilled water; 3) condensate and microbe sample only. The samples were kept at 20°C for 22 days and 37°C for 49 days. Gas samples were taken on days 7, 13 and 22 and days 7, 21 and 49 respectively, and analyzed using gas adsorption and gas-liquid chromatography. The condensate was analyzed using the vapor phase equilibrium method. The total number of Pseudomonas aeruginosa microbes was also counted. Where microbes were included in the samples they were found to multiply, both in the presence and the absence of the paint and varnish samples. Multiplication was faster at 37°C. At both temperatures, the paint sample, condensate and microbe mixture emitted carbon dioxide, acetone and toluyl, n-butanol, xylene isomers and ethylbenzene; however, monomer-epichlorhydrin and components of the enamel solvent were not found. The mixture of condensate, enamel and microbes emitted 20 times the amount of acetone emitted by the the control (enamel + distilled water). The amount of n-butanol emitted was also higher at both temperatures in the experimental condition, more so under the higher temperature. The amount of xylene isomers and ethylbenzene, on the other hand, was significantly lower in the presence of the microbes. The authors interpret these results as emphasizing the need for further detailed and systematic study of the behavior of non-metallic materials in the presence of a standard set of test cultures.

Table Title: Concentration of volatile substances for samples kept at 37 and 20°C

P135(10/85)* Pashin SS, Solomin GI. Functioning of the olfactory organ in hermetically sealed chambers. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4):90-93. 1985. [9 references; None in English] Affiliation: Not available

Habitability and Environmental Effects, Sealed Chambers

Humans

Sensory Physiology, Olfaction

Abstract: Since the presence of persistent odors may have particularly adverse effects in hermetically sealed chambers, odorimetric studies of substances to be present in such chambers are relatively common. However, such studies have been made under ordinary laboratory conditions and do not account for the possibility that prolonged confinement of human beings in such chambers may alter the functioning of the olfactory organ. The present study attempts to identify such changes in three individuals spending 3 months in a sealed chamber with a normal atmosphere. Olfactory functioning was evaluated through testing the olfactory threshold for the substance butyl acetate (a common offgas component of materials used in sealed chambers, including the cabin in Salyut-6). Every two weeks during their stay in the chamber, subjects were tested with nine pipettes: five pipettes contained various concentrations of the test substance; the remaining four, used as controls contained pure air. In the course of one month the olfactory threshold for detecting butyl acetone dropped from an average of 0.02 to 0.002 mg/l, indicating a substantial degree of sensitization. The threshold remained at this level throughout the subsequent two months of confinement to the chamber. It is suggested that this result has important implications in the design of components and spacecraft cabin atmospheres.

Table Title: Changes in the olfactory threshold for butyl acetate in subjects at various times during confinement in a sealed chamber

HEALTH AND MEDICAL TREATMENT

(See also: Cardiovascular and Respiratory Systems: P94.)

P136(10/85)* Naydina VP, Avetisyants BL, Dubinin DM. Gas chromatographic analysis of free fatty acids of skin lipids. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 93-94; 1985. [11 references; 10 in English] Affiliation: Not available

Health and Medical Treatment, Skin Lipids
Humans, Males
Gas Chromatography

Abstract: A correlation has been found between the type and number of microorganisms on the skin and the formation of free fatty acids in cutaneous fatty secretions. This study attempts to develop a gas chromatographic method for analyzing these acids. Samples of skin oil were taken using an ethyl alcohol rinse from males of two different age groups approximately 12 hours after they had last bathed. The samples were placed in standard oxygen solutions and converted to methyl ether derivatives through a series of steps. They were then extracted with hexane, evaporated in a stream of nitrogen, CCl_4 was added and the resulting solution injected into a chromatograph. Results indicated that the major components of skin lipids were fatty acids with 14-24 carbon atoms. No significant differences were found in acid composition of skin lipids of the back and hands for a single age group; however there were some differences between individuals aged 25-35 and those aged 45-55.

Table and Figure Titles: Table 1: Concentration of free fatty acids in skin lipids from the back and hands of men aged 45-55

Table 2: Concentration of free fatty acids in skin lipids from the faces of men in two age groups

Figure 2: Chromatogram of methyl ethers obtained from the free fatty acids of skin lipids from the faces of men aged 25-35 and 45-55

IMMUNOLOGY

P101(10/85) Voytko NYe, Yatsishina TA, Vysotskiy, Konovalova LS.
Cellular and humoral immunity in volunteers consuming diets differing
in protein content. Voprosy Pitaniya. 1985(3): 28-33. [18
references; 14 in English] Affiliation: Nutrition Institute, Academy
of Medical Sciences, Moscow.

Immunology, Cellular and Humoral
Humans
Nutrition, Protein

Abstract: This study examined the effects of deficits in dietary protein on the activity of the immunologically competent cells which mediate cellular and humoral immune response. Three different food rations containing fixed percentages of different types of protein were developed. Each of these was tested in an experiment lasting 52 days, during which eight male adults were fed a controlled diet consisting of 2780 calories per day. In the baseline 10-day period, protein constituted 16% of these calories. The remaining 42 days were divided into three periods of 14 days each during which dietary protein was diminished by varying amounts. Protein constituted 5%, 9% and 13% of the diet in the first, second and third of these periods respectively. T-cell activity was studied by observing lymphocytes from peripheral blood with several tests including: 1) blast transformation reactions of mononuclear cells in vitro in non-specific mitogens - PHA and concanavalin A; 2) lectin induced cytolysis of target cells treated with concanavalin A; 3) leukocyte migration inhibition tests; and 4) suppressor activity of T-lymphocytes in response to concanavalin A. Immunological competence of the B-system of lymphocytes was estimated from concentrations of IgG, IgM, IgA, IgD and IgE in the blood serum. Levels of natural staphylococcal antibodies in the blood plasma were also determined. When protein was reduced to 5% and 9% of the diet, regardless of food ration consumed, magnitude of blast transformation reactions decreased significantly. Some non-significant reduction also occurred with protein reduced to 13% of the diet. Leukocyte migration was analogously diminished by the experimental diets. Magnitude of cytotoxic response to target cells treated with concanavalin A was found to be directly proportional to the amount of protein in the diet, regardless of protein type. Suppressor activity was reduced in subjects consuming diets composed of 5% and 9% protein, but not in those on 13% protein diets. Changes in levels of the five immunoglobulins studied were complex, varying for different immunoglobulins and different food rations. Levels of some immunoglobulins actually increased during consumption of reduced protein diets. Titers of staphylococcal antibodies were also reduced to a statistically significant extent in all but two cases.

P101

Table Titles: Table 1: Proliferative response of peripheral lymphocytes to mitogens in volunteers consuming various amounts of dietary protein

Table 2: Inhibition index of leucocyte migration in volunteers consuming varying amounts of dietary protein

Table 3: Cytotoxic response of lymphocytes to target cells in volunteers consuming varying amounts of dietary protein

Table 4: Concentration of immunoglobulins in blood serum of volunteers consuming varying amounts of dietary protein

Table 5: Level of natural staphylococcal antibodies in the blood serum of volunteers consuming varying amounts of dietary protein.

P102(10/85) Surkina ID, Orlova ZS, Borodin YuV, Sharova TL, Bogdanov NG, Smirnova AN, Pyatnitskaya IN, Larina TI. Immune competence and vitamin level of highly trained athletes. *Teoriya i Praktika Fizicheskoy Kul'tury*. 1985(4): 37-39. [10 references; 4 in English] Affiliation: All-Union Scientific Research Institute of Physical Culture; Nutrition Institute of the USSR Academy of Medicine.

Immunology

Humans, Athletes

Nutrition, Vitamins

Abstract: Endogenous vitamin deficiency frequently occurs in athletes who undergo intensive training. Little is known about the effects of endogenous deficiencies on the immune system, although exogenous vitamin deficiency is known to have an adverse effect on immune responses. This study examined immunological parameters in 20 highly skilled male and female speed skaters during various stages of the training cycle. Measurements included concentration of G-lymphocytes in the blood, and parameters indicative of the activity of these lymphocytes. Levels of vitamin A, C, carotenoids, and certain B vitamins were estimated by measuring concentration of vitamins in the blood, excretion of vitamins or their metabolites in urine, activity of the enzymes which metabolize the vitamins and the degree to which these enzymes activated co-enzymes in vitro. Even at the start of the training cycle (i.e., after a period of relative inactivity), the athletes showed diminished immune responses in comparison to the norm. This was true for all the T-system parameters. Vitamin C deficiency occurred in 14/20 athletes at this point in the cycle, while 13/20 showed a deficiency in thiamin, 4 in riboflavin, 11 in niacin, and 14 in pyridoxine. The next measurements were made directly after the most physically demanding portion of the training cycle. During this period the athletes had been given vitamin supplements. Measurements showed that there had been an improvement both in immune system activity and in vitamin levels. However, in these sets of parameters, athletes still fell short of their non-athlete counterparts. Athletes showed a further decrease in proliferative capacity of T-lymphocytes, suggesting a problem in DNA synthesis. The authors relate this result to thiamin deficiency in the athletes during this period. They also point out that the vitamin supplements given to the athletes during training do not contain minerals, such as zinc, which are important to DNA synthesis in lymphocytes. They conclude that the initial set of results indicates the desirability of administering supplementary vitamins to athletes before the beginning of a new season. Inclusion of additional thiamin and minerals in the vitamin supplements which are typically given to athletes during intensive training may also be desirable from an immunological standpoint.

Table Titles: Table 1: Parameters of immune competence of speed skaters at the beginning of the training cycle

Table 2: Changes in the immunological status of speed skaters during training for an important competition

Table 3: Changes in vitamin levels in the bodies of athletes during training for an important competition

P103(10/85) Arlashchenko NI, Adamchik ZhF, Shtemberg AS, Klemparskaya NN, Dobronravova NN, Chukhrov AD. The effect of immunoglobulin on the work capacity of irradiated animals. *Seriya Biologicheskaya*. 1985(3): 404-411. [22 references; 4 in English] Affiliation: Institute of Biomedical Problems, USSR Ministry of Health, Moscow.

Immunology, Immunoglobulins; Radiobiology, Radioprotection

Mice, Rats

Work Capacity; Autoflora; Higher Nervous Activity

Abstract: This study examines the radioprotective effects of immunoglobulin administration on the work capacity and immunological response of mice, and on parameters indicative of higher nervous activity in rats. Immunoglobulins were injected 10 days before the start of irradiation. This time interval was selected because it had been previously observed that the positive effect of immunoglobulin on mouse work capacity peaked at 10 days after injection. Subjects in the first experiment were 120 male mice. Work capacity was operationally identified with the speed at which mice completed a swim of 130 cm, averaged over the 20th, 25th and 30th trials of a 30 trial block. Immunological responsiveness was identified with the amount of autoflora on the skin of the tail. Mice were first injected with immunoglobulins from the serum from non-irradiated normal or hemostimulated mice in doses of 0.5, 1 and 5 mg (25, 50, 150 mg/kg). Ten days later mice were irradiated with ^{137}Cs gamma rays in doses ranging from 5 to 10 Gy (1 Grey=100 rads). Work capacity was recorded at baseline and at 1 hour, 3, 7, 10, and 14 days after irradiation. By the 17th day all the irradiated animals had died. Two control groups of animals not receiving immunoglobulins were used; in the first the animals were given matched radiation doses and in the other no irradiation was performed. In all cases, irradiated animals treated with immunoglobulins showed significantly (Wilcoxon-Mann-Whitney tests) less decrement in work capacity than untreated irradiated controls. The radioprotective effect increased with increases in dose of immunoglobulin. Immunoglobulin from normal animals appeared only slightly less effective than immunoglobulins from hemostimulated animals. Immunoglobulin also decreased skin autoflora growth in irradiated mice. Globulins from normal animals were somewhat less effective than those from hemostimulated animals but both had a significant radioprotective effect. In the second experiment, 160 rats were given immunoglobulin in a dose of 200 mg/kg and ten days later irradiated with gamma-radiation in doses ranging from 5 to 10 Gy. Higher nervous activity was estimated in these animals on the basis of measured motor activity in an "open field" and retention of a passive avoidance response over a period of 24 hours. In irradiated control rats, motor activity initially increased immediately after radiation and then decreased relative to a non-irradiated group. Treatment with immunoglobulin appeared to diminish the initial increase in motor activity after irradiation. Irradiated animals treated with immunoglobulin showed better retention of a passive avoidance response in the first few hours after irradiation than did irradiated controls. In this experiment 60% of the rats treated with globulins and then irradiated died, while 80% of the irradiated controls died.

P103

Table and Figure Titles: Table 1: The effect of globulins on time to swim a minimum distance in non-irradiated CBA mice (n=6)

Table 2: Changes in swimming speed of rats after irradiation (n=6)

Table 3: Effect of preliminary injections of immunoglobulins on swimming speed of mice (CBA line) irradiated at a dose of 9 Gy (n=6)

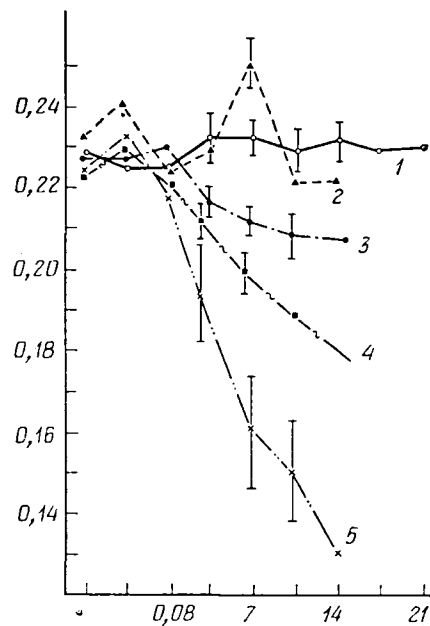
Table 4: Number of cases with more than 20 colonies of microorganisms on a plate (numerator) compared to total number (denominator) of animals studied, with and without injection of 5 mg of immunoglobulins

Table 5: Parameters of higher nervous activity in rats injected subcutaneously with immunoglobulins 10 days before irradiation at a dose of 10 Gy

Figure 1: Mean swimming speed of mice for a fixed distance under normal conditions and following injection of 5 mg immunoglobulins

Figure 2

Swimming speed: Curve 1: Normal mice (n=18); Curves 2-4: Mice irradiated at a dose of 9 Gy 10 days after injections of immunoglobulins at dosage of: Curve 2: 5 mg (n=6); Curve 3: 1 mg (n=6); Curve 4: 0.5 mg (n=6); Curve 5: mice irradiated without preliminary immunoglobulin administration (n=18).



Ordinate: swimming speed in m/sec.; Abscissa: time after administration of immunoglobulins in days

LIFE SUPPORT SYSTEMS

P129(10/85)* Yunusova LS, Drugova NA. A study of the microflora of the chufa plant -- a proposed component of biological life support systems. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(4):65-68; 1985. [4 references; None in English] Affiliation: None available.

Life Support Systems, CELSS
Botany, Higher Plants, Chufa; Microbiology, Microflora
Cultivation Conditions

Abstract: The chufa plant, a member of the sedge family, has been proposed as a component of a biological life support system because of the high fat and protein content of its tubers. The present study investigates incidence, development, and composition of microflora in the hydroponic cultivation of the chufa. Chufa plants were cultivated either alone or in combination with wheat or other vegetables, with either 18 or 24 hours of illumination per day. The plants were cultivated without a substrate; the root system was flooded with a nutritive solution every 16 minutes. Study of the microflora was divided into phenophases: I - the germinative period (7 days); II - sprouts; III - the beginning of tuber formation and; IV - technical maturity. Results indicated that the cultivation conditions (different illumination conditions and combination patterns with other plants) made no substantial difference in the development of bacterial flora. The level of such bacteria dropped when the tuber masses began to form (Phenophase III). The development of actinomycetes was similar to bacterial development when the chufa was grown alone with an 18-hour period of illumination. When the chufa was grown with wheat, there was an increase in the level of actinomycetes, especially on the roots. Under all conditions, but especially when the plant was grown in combination with others, there was an increase in the level of fungus on the rhizosphere toward the end of the growth period. Ammoniferes predominated among the groups of microorganisms which transform nitrogen containing compounds. In phenophase II, the processes of ammonification and denitrification intensified, and oligonitrophilic forms of bacteria appeared. Representatives of cellulose decomposing microorganisms appeared at the later stages of growth. Results were interpreted as indicating that, from a microbiological point of view, chufa plants can be included in biological life support systems either in monoculture or in combination with other grains and vegetables.

Table and Figure Titles: Table 1: Development of microflora during various stages in the growth of the chufa plant

Table 2: Development of microflora in the nutritive solution

P129

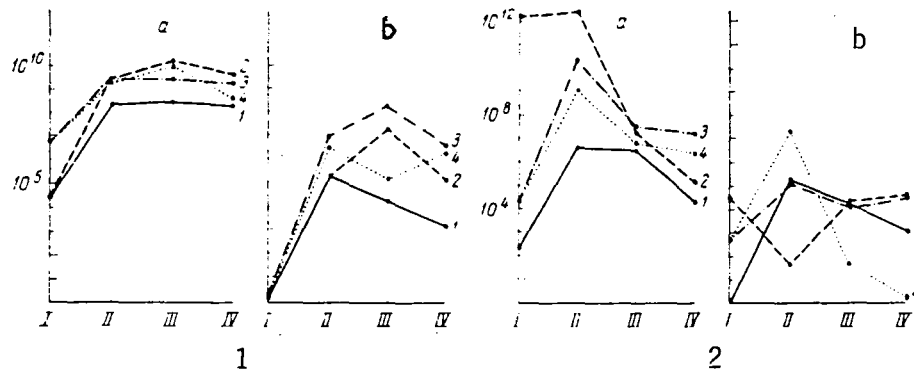


Figure 1: Development of ammonifying and denitrifying bacteria on the roots of the chufa plant

Abscissa: Chufa phenophase; Ordinate: Concentration of microorganisms on 1 g of roots; 1-2: chufa monoculture with photoperiods and continuous illumination respectively; 3-4: in polyculture with wheat and vegetables.

Figure 2: Development of ammonifying and denitrifying bacteria in the nutritive solution

Ordinate: Concentration of microorganisms in 1 ml of solution. Remaining labels identical to those in Figure 1.

P128(10/85)* Bergter F, Harz D, Muller PJ, Mund K, Gunther U, Hesse T, Hartmann R, Wanke G, Tairbekov MG, Parfenov GP, Pakhomov AI (GDR, USSR). Determining the growth coefficient of the biomass of Bacillus Subtilis under weightlessness. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4):63-65. [4 references; 2 in English] Affiliation: German Scientists: Institute of Microbiology and Experimental Therapy, Jena, GDR; Soviet Scientists: Not Available

Life Support Systems, Biomass Growth
Microbiology, Bacteria, Bacillus Subtillus
Spaceflight, Salyut-6, Weightlessness

Abstract: The growth coefficient is defined as the ratio $\Delta X / \Delta S$, where X is the total biomass and S is the quantity of substrate utilized. This indicator reflects the efficiency of metabolic process in a cell per unit of nutritive substrate used. The present experiment, performed on the "Salyut-6" space station, investigated the effect of weightlessness in terms of this ratio for bacterial cells. Cells of the Bacillus subtilus in suspension were grown in specially designed containers with five hermetically sealed chambers. One container was launched in "Salyut-6" and two others served as ground-based controls. Bacteria were transferred to one of the container chambers containing nutritive substrate. The concentrations of glucose and casein hydrolysate differed for each chamber in a container, but chamber concentrations were identical across the three containers. The experiment lasted 62 hours; at the end of this period suspension density, level of protein, concentration of glucose and total amino acid content were measured for each chamber. The growth coefficient of the biomass was then computed. For all three conditions, biomass increased linearly with concentration of nutritional material in the substrate. However, the rate of growth of the biomass exposed to weightlessness trailed the rate of growth of the controls by approximately 30%. The authors hypothesize that this effect is a consequence of weightlessness disrupting the distribution of the cells throughout the medium.

P128

Concentrations of glucose and casein hydrolysate in chambers of the "Jena" container

Chamber Number	Concentration of glucose g/l	Concentration of casein hydrolysate, g/l
1	0	0
2	1.25	1.25
3	2.50	2.50
4	3.75	3.75
5	5.00	5.00

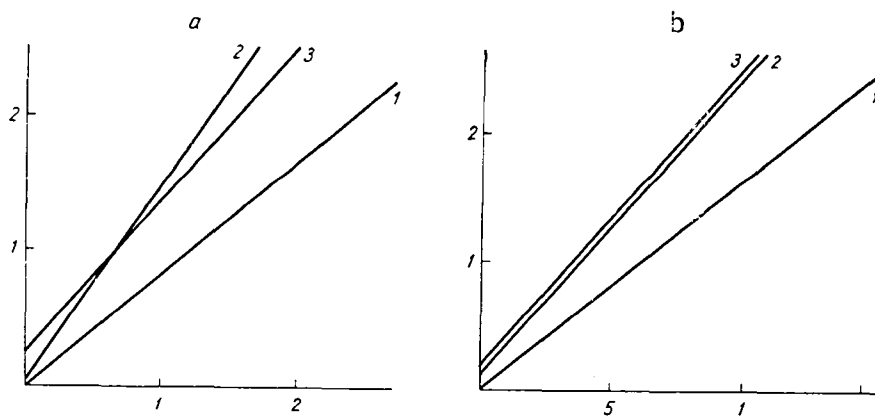


Figure: Production of protein by the cells as a function of consumption of glucose (a) and casein hydrolysate (b)

Abscissa: concentration of glucose and casein hydrolysate, respectively; Ordinate: concentration of protein (in $\text{g/l } 10^{-1}$).
1: flight; 2 and 3: control conditions in Baykonur and Jena, respectively

P130(10/85)* Antonyan AA, Levinskikh MA, Sukhova NI. Study of the growth, development and metabolism of the Closteriopsis acicularis under conditions of limited nitrogen from the standpoint of biological life support systems. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(4):69-73; 1985. [27 references; 3 in English]
Affiliation: None available.

Life Support Systems, CELSS
Microbiology, Algae, Closteriopsis acicularis
Nitrogen Deficit

Abstract: From the standpoint of human biological life support systems, it is desirable to increase the level of nitrogen-free substances in the biomass of the algae components of such systems. The present study attempted to achieve this goal by growing a new strain of green unicellular algae, Closteriopsis acicularis, under conditions of nitrogen deficit. This algae was cultured either in a medium supplying full nitrogen requirements or in a nitrogen-deficient medium in a continuous and cumulative regime. For both cultures values were determined for growth rate, culture productivity, protein level in the biomass and amount of carbohydrates and lipids. Measurements were made 8 times at irregular intervals over a period of 40 hours. The algae grown in a medium with normal nitrogen content ($\text{KNO}_3=2.9 \text{ g/l}$; $\text{KH}_2\text{PO}_4=0.55 \text{ g/l}$; $\text{MgSO}_4\cdot 7\text{H}_2\text{O}=0.47 \text{ g/l}$) grew at a peak rate of $0.405 \text{ g/l per hour}$. Mean daily productivity of the algae was 9.7 g/l ; and growth in the number of cells was parallel to the increase of the dry matter in the biomass. Nitrogen content of normally cultured algae was 55-62 mg/g of the dry biomass, corresponding to protein levels of 36-39%, lipid levels of 13-16%, and carbohydrate levels of 33-38%. As nitrogen was removed from the medium, growth rate continued at the normal rate by consuming intracellular reserves and continued on this level until nitrogen content dropped to $27 \text{ g/l dry weight}$. Growth rate then slowed and ceased; growth in number of cells remained unchanged for 4 hours after removal of nitrogen. Cell division ceased 4-5 hours before growth ceased. In the initial period of linear growth following removal of nitrogen, the protein content in the algae cells decreased and the synthesis of carbohydrates increased, while the amount of lipids remained constant. During the time that growth was slowing the protein content continued to decrease and the carbohydrate content to increase. No significant changes were observed in cell composition after growth ceased. The authors suggest that their data can be used in developing a human diets from biological life support systems which include Closteriopsis acicularis.

Table and Figure Captions: Table 1: Range of values for biochemical components of Chlorella and Closteriopsis acicularis at various points of the growth curve during nitrogen deprivation

Table 2: Major fractional components of carbohydrate at two growth phases of Closteriopsis acicularis with cellular deficit in nitrogen

P130

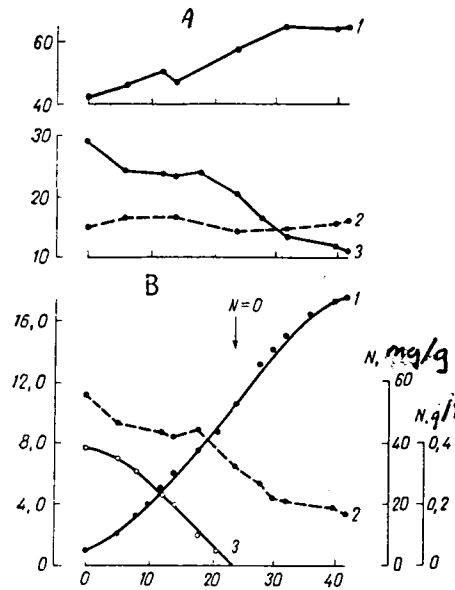


Figure 1: Biomass growth (1), number of cells (2), concentration of nitrogen (3), phosphorous (4), magnesium (5) and sulphur (6) over time during intensive cumulative cultivation under conditions of adequate supply of nitrogen (A) and nitrogen deficit (B)

Abscissa: length of time algae were under cultivation (in hours);
Ordinate: Above: number and dry mass of alga cells; Below: concentration of nitrogen, phosphorous, sulphur and magnesium in the medium

Figure 2: Composition of biomass of Closteriopsis acicularis under cumulative cultivation with nitrogen deficient medium

A -- concentration of carbohydrates (1), lipids (2), and protein (3) in the biomass during cumulative culture growth; B -- algae growth (1); nitrogen concentration in cells (2) and in the medium (3).

Figure 3: Carbohydrate and lipid content as a function of level of nitrogen in the biomass

P137(10/85)* Levinskikh MA, Livanskaya OG. Study of the mineral requirements of a new strain of algae proposed for biological life support systems. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 95-96; 1985. [3 references; None in English]
Affiliation: Not available.

Life Support System, CELSS
Microbiology, Algae, Closteriopsis
Mineral Requirements

Abstract: The one-celled green algae, Closteriopsis acicularis var. africa Hind has been proposed as a component of biological life support systems because, unlike Chlorella, it has a cell wall which readily breaks down and it contains a significant amount of easily digestible carbohydrates. However, no information is available concerning its requirements for minerals and other biogenic elements. In this study, the algae were cultured under two regimens: extensive -- in flasks illuminated at 10-12 kilolux with continual air flow containing 1-2% CO₂; and intensive -- in a rotating reactor illuminated at 60 kilolux with an air supply containing 2-5% CO₂. The quantity of biogenic elements required by the algae was determined from the removal of these elements from the medium during the cultivation period, as well as from the accumulation of these elements in the biomass. These determinations were made during the linear growth period, using a medium containing all minerals necessary for growth. Results indicated that the algae's mineral requirements decreased under the intensive regimen. This was particularly true of N and P, which demonstrates the high lability of the biomass of this algae. The results of this study permitted the determination of the optimal medium for continuous cultivation of Closteriopsis using a recirculating medium.

Table Titles: Table 1: Loss of mineral elements from the medium and accumulation in the biomass under cumulative cultivation of Closteriopsis

Table 2: Composition of balanced solutions for continuous cultivation of Closteriopsis

P104(10/85) Fishteyn GN, Kovrov BG. Microecosystems and a case study of their use for studying the life of protozoa in a community of microscopic organisms. Zhurnal Obshchey Biologii. XLVI(3): 336-344; 1985. [16 references; 7 in English] Affiliation: Institute of Experimental Biology, Estonian Academy of Science; Institute of Biophysics, Siberian Division, USSR Academy of Sciences

Life Support Systems, Microecosystems
Microbiology, Algae, Chlorella; Bacteria; Protozoa, Tetrahymena
Light, Peptone

Abstract: The capacity of protozoa to survive in a closed aquatic microecosystem was studied by introducing Tetrahymena into two closed systems composed of Chlorella, two types of bacteria, and a microscopic fungus suspended in a mineral medium, sealed in a vial. The effects of the addition of Tetrahymena to the ecosystems on the quantity and chlorophyll content of other organisms was determined. The effect of variable lighting conditions on biomass size and chlorophyll was investigated for ecosystems with and without Tetrahymena. The effects of variable lighting conditions and the addition of different amounts of peptone on survival of the Tetrahymena was also determined. The rates of respiration and photosynthesis in systems with and without Tetrahymena were compared. Cell populations of the component organisms over a number of days were determined for systems placed under continuous illumination and alternating periods of light and dark. Results indicated that the protozoa could survive in the microecosystem, requiring only light for their survival. They acted to accelerate the cycles of the system. The number of protozoa in the system depended on photosynthetic activity of the Chlorella; if the activity of the Chlorella became relatively intense, the Tetrahymena did not survive. This situation was observed during periods of continuous illumination, but not during alternating periods of light and darkness. The Tetrahymena ate mainly bacteria, and were weak consumers of the Chlorella. From the point of view of decreasing the length of succession and accelerating microevolutionary processes, organisms which are better consumers of the Chlorella and more resistant to their toxic effects would be more desirable. On the other hand, the Tetrahymena, as the most sensitive organisms in the closed microecosystem, can serve as indicators of the general state of the system. The use of closed microecosystems is recommended for verifying ecological hypotheses derived from observed microorganisms in nature.

Table and Figure Titles: Table 1: The effect of varying illumination and adding peptone to the medium in the presence of Tetrahymena in microecosystem 05041

Table 2: Population of organisms (cells in ml) and chlorophyll content in stable microecosystems

Table 3: Intensity of respiration and photosynthesis in microecosystem 05024

Table 4: Effects of continuous illumination on population (cells/ml)
in amicroecosystem 05041

Figure 1: Ampoule and vessel for measuring metabolic rate

Figure 2: Effects of lack of illumination on biomasses and chlorophyll
in microecosystem 05041

Figure 3: Effects of the presence of protozoa on biomass and chlorophyll
in microecosystems 05041 and 05024

Figure 4: Flux in population of organisms in microecosystem 05041
during periods of light and darkness

METABOLISM

P118(10/85)* Libkind VI, Vlasov VD. The effect of physical activity on lipid metabolism in pilots. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 29-31; 1985. [5 references; 1 in English] Affiliation: Not available

Metabolism, Lipids

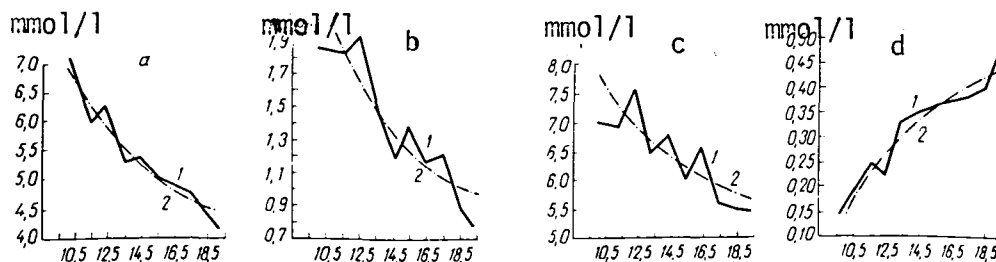
Pilots

Physical Work Capacity

Abstract: The goal of this study was to compare the effect of physical activity with several indicators of lipid metabolism. One hundred and five healthy pilots (presumably all male) were asked to participate in an ergometric bicycle test and were then classified into three groups (high, average and low physical work capacity) on the basis of test results. Groups appeared otherwise equivalent in age and other factors. For each pilot, concentrations of the following indicators of lipid metabolism were determined: total lipids, total cholesterol, triglycerides, lipoprotein-chylomicron fractions, very low density lipoproteins, low density lipoproteins, and high density lipoproteins. Statistical analyses were performed on the data. These analyses revealed a significant negative correlation between physical work capacity and concentration of total cholesterol (highest correlation), triglycerides, total lipids and low density lipoproteins in the blood. Levels of high density lipoproteins were positively correlated with physical work capacity. Exercise is recommended for pilots to diminish the risk to flight safety associated with cardiovascular problems.

Table and Figure Titles: Table: Results of full correlational analysis of the relationship between lipid metabolism parameters and PWC₁₇₀

Figure: Changes in concentration of lipids in the blood as a function of the level of physical work capacity



Abscissa: PWC₁₇₀ in kg-m/kg-min; **Ordinate:** Concentration of: a - cholesterol in mmol/l; b - triglycerides in mmol/l; c - total lipids in g/l; d - high density lipids in g/l.

P120(10/85)* Vlasova TF, Miroshnikova YeB, Ushakov AS. An investigation of certain aspects of amino acid metabolism in humans exposed to 120 days of hypokinesia with head-down tilt. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 35-38; 1985. [12 references; 3 in English] Affiliation: Not available

Metabolism, Amino Acids

Humans

Hypokinesia, Head-down Tilt

Abstract: Six people (sex and age not specified) were subjected to 120 days of hypokinesia with head-down tilt of -4° . The concentration of free amino acids in their blood plasma was determined with an automated amino acid analysis. Blood for the analysis was taken once before and four times during the hypokinesia period, and three times during a 14 day recovery period. Of the seventeen free amino acids monitored, only cystine and aspartic acid remained unchanged throughout the monitored period. By day 67-70 of the treatment, total amino acid levels had increased by a factor of 1.5, with 11 of the 17 individual acids increasing in concentration. By day 94-96, the total amino acid pool had increased to its highest level of 1.8 times the baseline concentration. By day 109-113, the concentration of leucine, phenylalanine, and glutamine had dropped to approximately baseline levels, while concentrations of most other acids had decreased slightly. Total amino acid concentration had not returned to its baseline level by the 14th day of the recovery period, with only serine, methionine, glycine and arginine approaching their normal concentrations. Changes in free amino acid concentration under prolonged hypokinesia are attributed to a decrease in anabolic processes and an increase in catabolic processes.

Table Titles: Table 1: Concentration of free amino acids in subjects' blood plasma during 120 days of hypokinesia with head-down tilt

Table 2: Concentration of free amino acids in subjects blood plasma during recovery period following prolonged hypokinesia with head-down tilt

P123(10/85)* Shidovskaya TYe. Lipid peroxidation rate in tissues of rats subjected to hypokinesia. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, 19(4):42-45; 1985. [13 references; 6 in English] Affiliation: None given.

Metabolism, Lipid Peroxidation

Rats

Hypokinesia, Immobilization Stress

Abstract: This study investigated lipid peroxidation rate in mitochondria and homogenates of the liver, heart and skeletal muscles of rats exposed to hypokinesia of variable duration. Sixty-five male albino rats formed the experimental group, while 51 comparable animals served as the control group. The experimental animals were kept in immobilization cages and sacrificed on days 3, 7, 15 or 30 of hypokinesia. Lipid peroxidation rate for heart, liver and skeletal muscle homogenates and mitochondria was estimated through measurement of diene conjugates and malondialdehyde (MDA) in the presence of NADPH₂ or ascorbic acid. Results indicated that there was a significant accumulation of the initial products of lipid peroxidation, i.e., diene conjugates, in the liver (20% above that of control animals) by the third day of hypokinesia. By day 7, this level dropped to the control level, but increased again on days 15 and 30 (exceeding control by 53% and 29%, respectively). The level of MDA, an index of NADPH₂ and ascorbate dependent lipid peroxidation, remained at control level until days 15 and 30 when there was a non-significant tendency toward increase relative to that of the control animals. Similar effects were noted in the myocardia, but the increase in MDA concentration was first noted on day 7. Results were again similar in the skeletal muscles. By day 30, diene conjugate levels in the experimental animals exceeded those of the controls by 77%. Increases in levels of lipid peroxidation indicators after 3 days of hypokinesia are interpreted as resulting from stress response to hypokinesia. Decreases in these levels by day 7 are attributed to the body's defense mechanisms controlling the initiation of lipid peroxidation and detoxification of peroxidation products. It is suggested that the absence of changes in MDA accumulation are associated with a blockage of lipid peroxidation at the stage of formation of lipid hydroperoxides. Results on days 15 and 30 are interpreted as representing breakdown of the protective/ defense mechanisms which are unable to cope with immobilization stress of this duration.

Table Title: Concentration of lipid peroxidation products in the liver, myocardia and skeletal muscles of rats subjected to hypokinesia

P127(10/85)* Davydova NA, Senkevich YuA, Belakovskiy MS, Samratova SV.
 Study of catecholamine metabolism under high altitude conditions.
 Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 60-63;
 1985. [13 references; 5 in English] Affiliation: Not available

Metabolism, Catecholamines
 Athletes, Mountain Climbers
 Adaptation, High Altitude; Training

Abstract: The purpose of this study was to investigate the ability of the human body to adapt to high altitude conditions and the effects of preliminary training on this ability. Indicators of catecholamine metabolism were used as the dependent variable. Two groups of athletes served as subjects. The first group (N=25) consisted of potential members of an Everest expedition undergoing training at a height of 1700 m above sea level. Blood and urine samples were taken from them before and after ascent of a 4376 m mountain. The second group had undergone no special training and climbed as high as 4000 m. Urine samples were taken before and after this climb. Activity of the sympathetic-adrenal system was assessed by measuring epinephrine and norepinephrine levels in blood plasma (Group 1 only) and excretion of epinephrine, norepinephrine, dopamine and dopa in the urine (both groups). Various assessments of the relative activity of catecholamine metabolisms were also made. Before the climb, blood from athletes in the first (trained) group had higher than normal levels of both catecholamines. After the climb, the level of epinephrine and norepinephrine rose still further. Excretion of epinephrine, and DOPA, was normal before the climb, and elevated after it. Ratios indicating catecholamine synthesis activity were within normal limits throughout. In the second group, only excretion of epinephrine was elevated before the climb; all other indicators were within normal limits. After the climb, there was an increase in norepinephrine excretion and epinephrine excretion remained high. Excretion of dopamine and dopa was somewhat depressed as was the ratio of epinephrine to norepinephrine excretion. These results are interpreted as indicating that the combination of physical exertion and high altitude hypoxia enhanced catecholamine synthesis in the untrained group. Evidently, training minimized these effects.

Table Titles: Table 1: Concentration of catecholamines in the blood and urine of athletes in the first group

Table 2: Excretion of catecholamines and dopa in the urine of athletes in the second group

MICROBIOLOGY

(See LIFE SUPPORT SYSTEMS: P128, P129, P130, P137, P104)

MUSCULOSKELETAL SYSTEM

P121(10/85)* Grigor'yeva LS, Kozlovskaya IB. The effect of 7 days of immersion hypokinesia on fine motor control [literally: precise movements]. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 38-41; 1985. [10 references; 3 in English] Affiliation: Not available

Musculoskeletal System, Motor Control
Humans, Males
Hypokinesia, Immersion

Abstract: Seventeen healthy men were subjected to a 7- day period of hypokinesia induced by the "dry" immersion procedure. Before and 1 and 3 days after the immersion period, the subjects were asked to reproduce from memory a series of graded isometric tensions with their shin muscles, as well as a series of angular displacements performed by flexing the ankles. An isometric dynamometer was used both to introduce stimuli to be reproduced and to test task performance accuracy before and after immersion. Accuracy was measured in terms of moments of force for the first task and angular displacements for the second. After immersion, errors, variability and time to perform the movements increased considerably for both tasks. For example, in the isometric tension task, errors increased from approximately 5% to about 25%. Performance decrement was comparable on both tasks. On the third day after immersion, task performance improved and was comparable to baseline in all but two subjects. Examination of the structure of task movements before and after immersion revealed a change from smooth, automatic, rapid movements to movements which were slow and fragmentary, as if a successive approximation strategy was being employed. These changes are attributed to disruption of normal automated motor control and feedback. In both the tension and the displacement tasks, performance deteriorated most when plantar flexing was required. Since loss of muscular tonus associated with hypokinesia is most pronounced in the extensor muscles of the legs, which also control plantar flexion, the results obtained are attributed to loss of muscle tonus resulting from hypokinesia. However, the positive correlation between magnitude of errors for different tasks and muscle groups is interpreted as indicating the involvement of common central mechanisms.

Figure Titles: Figure 1: Diagram of motor tasks.

Figure 2: Errors, variance and latency for reproducing a given level of tension (A) or displacement (B) before and after hypokinesia induced by immersion

Figure 3: Reproduction of given levels of tension before and after hypokinesia induced by immersion in six subjects

Figure 4: Accuracy of movement (plantar flexing) before and after hypokinesia induced by immersion

P124(10/85)* Shvets VN, Burkovskaya TYe, Vnukova ZYe, Kabitskaya OYe.
The effect of 24, 25-dihydroxyvitamin D₃ on osteoprogenitor cells in
immobilized rats. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina.
19(4): 48-53; 1985. [15 references; 7 in English] Affiliation: Not
available

Musculoskeletal System, Osteoporosis

Rats

Immobilization; Nutrition, Vitamin D

Abstract: This study investigated the effect of vitamin 24,25 (OH)₂D₃ on immobilization induced osteoporosis in rats. Rats serving as subjects (number unspecified) were divided into four groups. Group 1 served as a control. Rats in Group 2 were kept in a tail suspension stand for 35 days. Rats in Group 3 were also immobilized in the stand, but in addition were given daily doses of 1.25 microgram 24,25(OH)₂. Group 4, also a control group, received identical doses of vitamin D without the immobilization treatment. After completion of the experiment, 2-5 rats from each group were sacrificed and the bone marrow extracted from their hip and shin bones. The osteogenic potentials of the bone marrow cells were estimated through heterotopic transplant of the bone marrow below the kidneys of healthy rats. This procedure is used to evaluate the osteogenic potential of hemopoietic cells on the basis of their capacity to form bone tissue at the transplantation site. After 21 days, the kidneys were removed and subjected to histological and morphometric examination. Results indicated that the tail suspension procedure led to a significant decrease in the weight of the transplanted bone tissue. The administration of vitamin D to immobilized rats completely eliminated the reduction in osteogenic potential of bone marrow cells. Morphometric analysis of the proportion of trabecular bone showed that the bone marrow of immobilized rats formed less dense bone, as compared to marrow of control rats. Vitamin D reversed this effect to some extent, but still did not restore the proportion of spongy bone to the control level. In vitro cloning of bone marrow cells from the four groups of rats was also performed. It has been hypothesized that osteogenic cells engender colonies of fibroblasts in vitro. The number of colonies formed was decreased by a factor of four for cells from immobilized animals as compared to cells from control animals. Administration of vitamin 24,25 (OH)₂D₃ to immobilized animals restored this capacity to its normal level, but did not affect proliferation of cells within colonies. Immobilization also affected the ratio between compact reticulate colonies for some types of fibroblasts within the colony. In this case, vitamin D did not mitigate the effects of immobilization. The authors interpret these results as indicating that one factor leading to immobilization osteoporosis is inhibition of histogenic activity on the part of stromal precursor cells. Vitamin D is hypothesized to reactivate these cells.

Table and Figure Titles: Table 1: Parameters of bone developing under the kidney capsule

Table 2: Mean size of colonies of various types

P124

Table 3: Ratio between colonies differing in structural density of cells

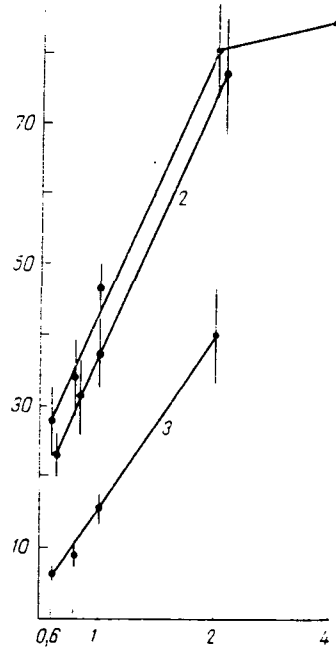


Figure 1: Linear relationship between the total number of fibroblast colonies and concentration of explanted cells from control rats (1), immobilized rats given vitamin 24,25(OH)₂D₃ (2) or immobilized only (3).

Abcissa: Number of cells X 10⁶; Ordinate: Number of colonies (M ± m)

Figure 2: Linear relationship between number of phosphatase positive colonies and quantity of explanted cells

P98(10/85) Chaykovskiy VS, Ivanova YeI, Posozkin VA. Content and utilization of testosterone in the cardiac and skeletal muscles of male rats after physical exercise. Problemy Endokrinologii. XXXI(3): 78-82; 1985. [10 references; 4 in English] Affiliation: Laboratory of Clinical Immunology of the Kiev Scientific-Research Roentgen Radiology, and Oncology Institute.

Musculoskeletal System, Cardiac and Skeletal Muscles; Also
Endocrinology, Testosterone
Rats, Males
Physical Exercise

Abstract: In two experiments, one group of rats was forced to engage in a program of physical conditioning exercise, while a second group of rats was treated similarly, but was not given the exercise program. Effects on level and utilization of testosterone were studied. Conditioning treatment occurred regularly during a 7-week period in the first experiment and a 4-week period in the second. Analysis for testosterone was performed the day following completion of the conditioning program. In the first experiment, the experimental rats were subjected to either endurance conditioning (through forced swimming) or strength training (involving weights but procedure not clearly specified). Testosterone concentration in the blood serum was determined through radioimmunoassay, and testosterone binding capacity of blood proteins was measured using tritiated testosterone. Serum testosterone concentration of rats which underwent strength training was 2.4 times that of the control animals, while the endurance training lowered serum testosterone level to about 60 percent of the control level. An analogous effect was found with regard to the testosterone-binding capacity of plasma proteins. The second experiment, employed a combined speed and strength training protocol in which experimental animals swam with attached weights. The effects of this treatment on the incorporation, level and androgen receptor binding of testosterone in the skeletal and cardiac muscles were evaluated using radioimmunoassay methods. Analysis showed that the physical conditioning program led to a decrease in the rate of androgen excretion and its concomitant retention in the body. In all but one of the tissues studied (back and thigh muscles, heart, testis, adrenal gland, adenohypophysis, kidneys and liver, but not the hypothalamus) and in the blood serum, retention of radioactivity 4 hours after administration of ^3H -Testosterone was twice as great for the experimental animals as for the controls. Physical exercise did not, however, affect the androgen receptor content in the skeletal muscles nor the testosterone concentration in active skeletal or heart muscles.

Table and Figure Titles: Table 1: Effect of various types of physical exercise on testosterone concentration and testosterone-binding capacity of blood proteins in rats

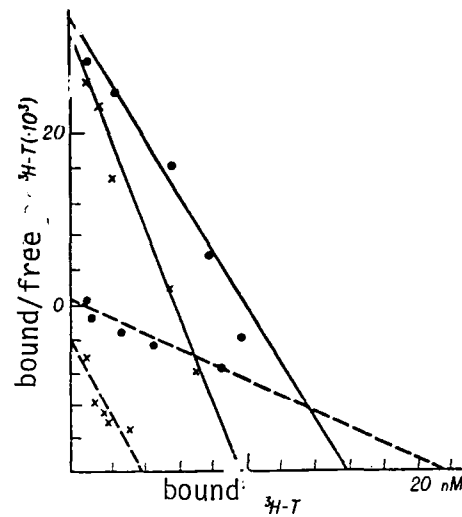
Table 2: Influence of physical exercise on distribution of radioactivity in organs four hours after administration of ^3H -T

Table 3: Effect of physical exercise on body weight and organs of rats

P98

Table 4: Effect of physical exercise on testosterone concentration in blood, and skeletal and cardiac muscles of rats

Figure: Effect of physical exercise on receptor binding of testosterone in the cytosol of skeletal (solid line) and cardiac (dashed line) muscles. Dots - control; Crosses - experimental rats.



P100(10/85) Smolyar VI. Effect of amino acid deficiency on growth and formation of bone tissue. Voprosy Pitaniya. 1985(3): 38-42. [18 references; 4 in English] Affiliation: Scientific Research Institute of Nutritional Hygiene, Ukrainian Ministry of Health, Kiev.

Musculoskeletal System, Bone Growth
Children, Rats
Nutrition, Amino Acids

Abstract: In the first study, 9634 school age children in four age groups were classified on the basis of their height relative to their age, and the amount of amino acids (threonine, lysine and methionine) consumed in their diets as determined from interview data and nutritional charts. A positive correlation was found for all age groups between the amount of each amino acid in the diet and height. In a second study, rats in the experimental group were fed a diet deficient in the three acids mentioned above, while a control group consumed a diet, containing nutritionally adequate amounts of these acids, but otherwise equivalent. The experiment apparently lasted 4 months, but this is not stated directly. Growth, weight gain, hydroxyproline and hexosamine content of the femur, concentration of calcium and phosphorous in the blood serum, and phosphomonoesterase-1 activity in the bones and blood serum were determined for both groups. Calcium/phosphorous, hexosamine/hydroxyproline, calcium/hydroxyproline and phosphorous/hydroxyproline molar ratios in the bones of the rats were also calculated. Phosphorous and calcium metabolism were studied and sections of bone tissue examined histologically. Student's t was used to analyze data. Deficits in the amino acids studied led to decreased growth of the femur and tibia, accompanied by weight gain relative to animals fed a protein rich diet having comparable caloric value. Other changes included decrease of free phosphorous in the bones, increase in calcium content and its molar ratio to phosphorous, increase in hydroxyproline content, decrease in the phosphorous/hydroxyproline ratio and in hexosamine content, increase in the hexosamine/hydroxyproline ratio and decrease in phosphomonoesterase-1 activity. Calcium excretion in the stools diminished leading to a decrease in overall excretion. Renal calcium excretion decreased only at the end of the experiment. Calcium retention of animals on the amino acid deficient diet was 7% higher than that of the control group and it accumulated in the bones. Both fecal and renal excretion of phosphorous decreased leading to increased retention. However, content of both minerals in the blood was not altered significantly by the protein deficient diet. The growth zone of cartilage did not assume the normal structure and consisted of degeneratively altered cells. A sharp decrease in the rate of proliferation of cartilage cells in the growth zone gave the appearance of premature aging. The most pronounced change in bone structure involved substantial thinning and decreased quantity of the trabecula in the epimetaphysial zone. In the epiphysis the majority of animals showed delayed closure of the ossification nucleus.

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Table and Figure Titles: Table 1: Content of mineral and organic components in the femur under conditions of amino acid deficiency

Table 2: Balance and retention of calcium under conditions of amino acid deficiency

Table 3: Balance and retention of phosphorous under conditions of amino acid deficiency

Figure 1: Threonine, lysine, and methionine content in the diet of urban and rural school children of various ages

Figure 2: Atypical structure of the growth zone in animals receiving a diet deficient in amino acids

Figure 3: Delayed closure of the ossification nucleus, porous structure of the substantia compacta of the diaphysis in animals fed a diet deficient in amino acids

NEUROPHYSIOLOGY

(See also: ENDOCRINOLOGY: P106)

P109(10/85) Sten'ko YuM, Varenikov II, Skrupskiy VA. Using electric sleep to prevent cumulative fatigue in sailors on long-term cruises. *Gigiyena Truda i Professional'nyye Zabolevaniye*. 1985(5): 42-44. [16 references; None in English] Affiliation: Institute for [Industrial] Hygiene in Sea Transport, USSR Ministry of Health, Moscow

Neurophysiology, Fatigue

Humans, Sailors

Sleep, Electric Sleep; Noise

Abstract: On long-term fishing cruises, up to 35 percent of the sailors complain of insomnia. This study compares the effects of electrically induced sleep, drug induced sleep and no measures taken against insomnia on the mental and physical work capacity, auditory threshold, noise level at which discomfort is experienced, and auditory readaptation time. Study of auditory parameters was deemed necessary because of the high background noise level in the quarters where sailors must sleep. Physical work capacity was associated with the maximum possible force exerted by hand muscles as measured by a dynamometer. Mental work capacity was determined by performance of a number of information processing tasks measuring processing speed and attention. Auditory threshold was determined using tonal audiometry. Auditory readaptation time was determined after 3 minutes of exposure to three tones of various frequencies (125, 1000, and 4000 Hz) at a constant volume of 40 dB. Discomfort noise level was determined directly using increasing levels of sound at 1000, 2000 and 4000 Hz up to a volume of 100 dB. Fifty-five sailors on a long-term cruise who had complained of insomnia participated in the study. One group of the subjects were given sleep-inducing drugs selected on the basis of type of sleep disturbance, apparently over a period of 20 days. A second group was given 20 one hour electric sleep inducing treatments using the "Elektroson-4 T" apparatus. A third control group of sailors received no treatment for insomnia. For all sailors noise levels in the sleeping quarters were sub-optimum. All participants worked day shifts throughout the experiment. Throughout the period of the experiment, the parameters listed above were measured each day for each sailor when he awoke, and physiological measurements were made during sleep using "actographic" methods (not defined). In addition, each sailor was asked daily to rate the quality of the previous night's sleep on an 18 point scale. Sailors in the control group complained of worsening symptoms of insomnia during the experimental period. Rating of sleep quality dropped 7 points; motor activity increased during sleep; time to fall asleep increased by 43 minutes; maximum length of peaceful intervals decreased by 14 minutes. Both mental and physical work capacity continued to decline over this period (by 0.14 bits/sec, and 18.3 kg/m respectively); auditory perceptual threshold increased, readaptation time increased and the discomfort threshold decreased. The group given sleep inducing drugs exhibited improvement in sleep quality (by 3.8 points on the rating scale), an 11 minute decrease in time to fall asleep, and a 7 minute increase in the maximum length of peaceful periods. However, a tendency for motor activity to increase during sleep testified to the

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abnormality of the drug induced state. Work capacity remained relatively stable over the period, but the auditory parameters indicated a slight decrement in auditory functioning. However, these effects were smaller than the ones for the control group. Subjects in the third group rated their sleep quality as improved and showed less motor activity during sleep than they had before treatment. Their data differed significantly from that of the control group. In electric sleep group physical and mental work capacity showed improvement during the treatment period by 11 kG/m and 0.17 bits/sec, respectively. Auditory parameters also improved. The method of electrically induced sleep is recommended for use with sailors suffering from sleep disorders on long-term cruises.

P110(10/85) Kabalova LA, Soldatkina SA, Zaytseva YeP. The state of the central and peripheral nervous systems during exposure to transport noise of varying intensity. Gigiyena i Sanitariya. 1985(6): 22-24. [7 references; None in English] Affiliation: F.F. Erisman Scientific Research Institute for Hygiene, Moscow

Neurophysiology, Sensorimotor Cortex; Also Psychology, Experimental
Neurosis, Learning
Rats
Noise

Abstract: This study investigated the effects of exposure to transport noise on various behavioral parameters of white rats. Thirty rats were exposed daily to 6 hours of noise equivalent to either 60 (N=15) or 80 dBA (N=15), for 30 days. Dependent variables examined included parameters measured in the "open field" test situation as indicators of motor and emotional activity. The animals' emotional state was assessed by counting instances of urination, defecation and washing. Long-term memory for a conditioned reflex was assessed by teaching the animals to run a T-maze for food starting one week before the beginning of the noise treatment. Values for all these variables were determined before initial exposure to noise and on the 3rd, 10th, 20th and 30th day of the treatment. After completion of the treatment, a morphological examination was made of the neurons in the 5th layer of the sensorimotor cortex of the brain. Animals exposed to 60 dBA exhibited significantly (Wilcoxon test) increased motor activity and decreased signs of emotion as the 30 day period of repeated noise exposure progressed. On the other hand, animals exposed to 80 dBA exhibited decreased motor activity and an increase in one sign of emotional lability. Signs of depressed motor activity continued in the latter group even after exposures to noise had ceased. Results from the T-maze task appeared to indicate that the animals exposed to 60 dBA learned faster and retained more than those exposed to 80 dBA of noise. By the end of the period, animals subjected to the higher level of noise showed more signs of aggressiveness and neurosis. Examination of the sensorimotor cortex indicated morphological changes in both groups of animals, including a decrease in normochromic cells and increase in dark hyperchromic nerve cells. The extent of these changes was directly correlated with the intensity of noise. Animals exposed to the higher level of noise showed additional signs of chromatolysis, increase in the number of neuroglial cells, and in the width of the capillaries in the sensorimotor zone. Changes noted in animals subjected to 60 dBA of noise are described as adaptive, associated with moderate stress on the neurons of the sensorimotor zone, and as supporting neurodynamic processes under the imposed environmental conditions. On the other hand, changes in the animals exposed to 80 dBA of noise demonstrated strain on the adaptive capacities of the central nervous system. In these animals the development of inhibitory processes in the brain cortex, and the appearance of signs of neurosis are consistent with the neurological signs observed.

Table Titles: Table 1: Motor and emotional activity parameters in rats.

NUTRITION:

(See BODY FLUIDS: P92; IMMUNOLOGY: P101, P102; MUSCULOSKELETAL SYSTEM: P124)

PERCEPTION

P115(10/85)* Lapa VV, Bukalov YeYe, Lemeshchenko NA. An investigation of the factors determining geocentric techniques used by pilots for orientation. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 19-23; 1985. [10 references; 1 in English] Affiliation: not available.

Perception, Orientation

Humans, Pilots

Visual Displays, Perspective

Abstract: This study is concerned with how a pilot forms an internal representation of his aircraft's position in space. Both flight and laboratory experiments were performed. Ten experienced pilots, as well as 10 subjects with no flying experience, participated in the flight experiment. In this experiment, a flight instructor put the plane into a predetermined landing path while the subject was prevented from seeing outside the plane. Then the cockpit curtains were opened allowing the subject to see both the ground and the wing of the plane; and the subject was asked to estimate the position of the plane in space using a laser landing system display. Estimates were evaluated on the basis of three parameters: heading, glide path and bank angle. The most striking result of this experiment was the virtual absence of errors made by pilots. Inexperienced flyers, on the other hand, totalled 41.3% errors; errors in determining lateral direction in the presence of banking were particularly common. Response latency was shorter for the pilots than for the novice fliers. On the basis of these results and comments made by subjects, the experimenters concluded that novices form representations of the motion of the plane with regard to a system of coordinates based on the position of their own bodies in space; pilots perceive this motion with regard to a mental system of coordinates representing a motionless earth. In the laboratory experiment, pilots were shown displays simulating the landing situation tachistoscopically. These displays varied in the amounts and types of information they represented. In some, only the laser system landing symbol was represented; in others, artificial horizon lines, linear perspective, the edges of the landing strip and a plane silhouette were added cumulatively. The pilots saw slides containing one of the displays and representing various deviations from the course set by the landing symbol in heading, glide path and/or bank angle. The pilots' task was to estimate the spatial position of the plane from the slide. Each pilot performed the task for a number of deviations and all cue versions. Responses were evaluated on the basis of latency and errors; verbal comments and additional interviews with subjects were also analyzed. Addition of the line representing an artificial horizon decreased the number of errors from 42.3% to 23.3%. Cumulative addition of the other visual cues further instantiating the geocentric system of coordinates improved performance up to a level of 2% errors. The addition of the horizon cue significantly decreased response latency, but no further decreases

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occurred with addition of other cues. All subjects stated preferences for the versions with more cues. The authors conclude that whether or not an individual uses an appropriate (in the given case, geocentric) spatial orientation technique during flight is a function of the specific content of his or her mental representation. This representation develops over the course of practical flight experience. The utility of a simulated representation for orientation depends, to a large degree, on how completely the geocentric coordinate system is represented by visual cues.

Table and Figure Titles: Table 1: Accuracy and response latency of pilots' spatial orientation from a simulation display containing spatial perspective cues

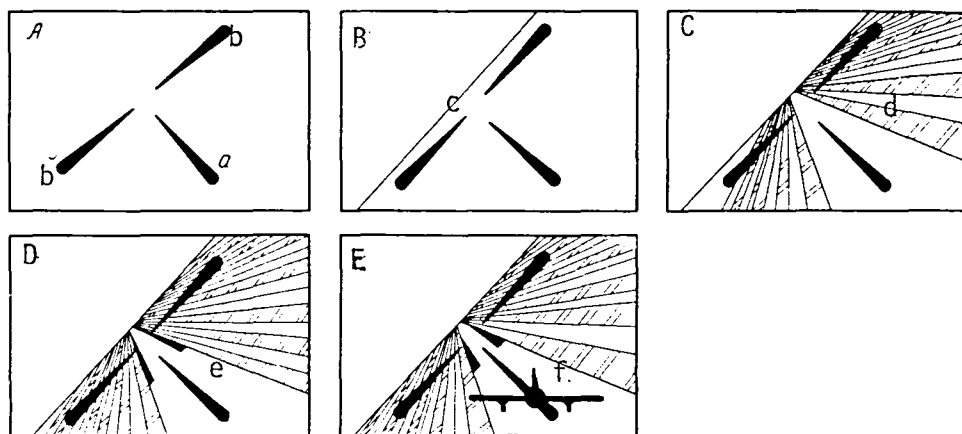


Figure 1: Types of simulation displays (A - D). a - indicator of heading; b - indicators of glide path; c - artificial horizon; d - linear perspective; e - edges of landing strip; f - aircraft silhouette.

Figure 2: Graph of distribution of response latencies for estimating spatial orientation

PERSONNEL SELECTION
(See Psychology: P117)

PSYCHOLOGY
(See also Perception: P115)

P117(10/85)* Bodrov VA, Kupriyanov AA, Fedoruk AG, Kharin VV. Use of pilot training simulators to detect functional capabilities of pilots. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 26-29; 1985. [8 references; none in English] Affiliation: Not available.

Psychology, Stress

Pilots; Patients, Functional Disorders

Personnel Selection, Training Simulator Performance

Abstract: This study investigates the utility of pilot training simulators for identifying the functional capabilities of pilots and prospective pilots and for predicting future performance breakdown under prolonged exposure to stressful flight conditions. Eighty-nine pilots undergoing medical examinations served as subjects. Members of the first group (N=31) had been diagnosed without flight related problems; members of the second group (N=21) had been diagnosed as suffering from functional cardiovascular disorders; and members of the third group (N=37) as having functional disorders of the nervous system [i.e., psychological disorders]. All subjects were flight certified. The study procedure involved assigning subjects to perform various complex aircraft control tasks on the simulator and then introducing additional complications into some of the tasks. These complications could be either intrinsic to the simulated flight situation (e.g., simulated equipment failure) or extrinsic (e.g., the requirement to perform complex numerical computations at high speed). Physiological measurements were made at stipulated points in the task, (e.g., during glide descent), and included heart rate, respiration rate and minute volume, galvanic skin response, and electromyogram of the flexor of the right hand. Performance level was evaluated from motion pictures of pilots performing tasks, records of simulated flight path and values of task appropriate parameters. Physiological measurements indicated that the pilots diagnosed as having functional disorders showed more signs of stress during task performance than those in the healthy group. The former groups also exhibited worse task performance than the latter group. All three groups, however, contained individuals whose physiological parameters were elevated substantially above the group means. As a rule, these individuals also performed their tasks poorly. The results of this study are taken as confirming the value of using flight simulators to assess and predict the functional capabilities of pilots.

Table and Figure Titles: Table: Mean time to perform the key actions involved in extricating a plane from a difficult position on the training simulator

Figure 1: Pilots' heart rate parameters during simulated landing approach

Figure 2: Total number of deviations from established flight parameters as pilots performed four simulated landing approaches

P116(10/85)* Tereplyak Ya, Matseychik (Poland). Resistance of psychomotor performance to anticipatory stress in pilots with varying anxiety levels. Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina. 19(4): 24-26; 1985. [14 references; 4 in English] Affiliation: None available

Psychology, Psychomotor Performance
Humans, Pilots
Stress, Anxiety Level

Abstract: Forty pilots of ultrasonic aircraft served as subjects in this experiment. Pilots were categorized as high or low in anxiety on the basis of responses to a preliminary questionnaire. The experimental task, an indicator of psychomotor performance, involved visual tracking of a point of light on the screen of a training simulator. Subjects were told they would receive a shock to their face when there was an error of a certain magnitude in tracking. Actually subjects received three shocks per session, regardless of performance level. Each of the 20 subjects in each anxiety group participated in seven sessions, one preliminary to introducing the shock contingency, two with the shock and four after the shock paraphrenalia had been removed. Heart rate was measured at rest and during each trial. Student's t was used in data analysis. No statistically significant differences in the effect of stress on performance were found between the two groups; however, the high anxiety group showed a tendency to higher variance, possibly indicating greater sensitivity. Performance of both groups improved under stress. Although the high anxiety group had a higher resting heart rate, no differential effects attributable to the experimental manipulation were found. Lack of effect is attributed by the authors to pilots' experience with stress and suppression of its negative effects on performance, regardless of their intrinsic anxiety levels.

Table and Figure Titles: Table: Results of the analysis of level of activation (heart rate)

Figure: Differences in performance of simulator task for individuals in the high and low anxiety groups

P112(10/85) Gambashidze GM, Tkhorevskiy VI, Yampol'skaya YeG. Human functional status during monotonous activity accompanied by various levels of physical strain. Gigiyena Truda i Professional'nyye Zabolevaniya. 1985(6): 5-9. [9 references; 1 in English] Affiliation: Institute for Industrial Hygiene and Occupational Diseases, USSR Academy of Medicine, Moscow

Psychology, Human Factors, Functional Status
Humans, Workers, Sex Differences
Physical Exertion; Monotony

Abstract: Two studies were conducted to investigate the effects of monotonous tasks which demanded varying degrees of muscular exertion on functional status. In the laboratory task, 10 men were required to lift and move weights varying from 0.5 to 15 kg at a rate of one every 6 seconds for a period of 2-4 hours. In the field conditions task, 48 female and five male bakery employees loaded bread under conditions similar to those in the laboratory study. Bread loads weighed no more than 1.5 kg and four to six thousand were lifted in the course of a shift. Functional status of the subjects and employees were evaluated using a number of psychophysical methods, including measurements of sensorimotor reaction time, time to complete test tasks, EKG recording, measurement of blood pressure, and recording of bioelectric activity of the muscles. In addition, subjects were interviewed about their sensations and studies of task performance were made. Heart rate was measured every 5-10 minutes in the laboratory and every half hour on the job. Other measurements were performed every hour in the laboratory and every two hours on the job. Of particular interest was the relative dominance of the reactions associated with monotony and those associated with muscular fatigue. Reactions to monotony include sensations of boredom and decreases in activation level of the central nervous system (e.g., slowing of sensorimotor reactions and decrease in heart rate and blood pressure). Reactions to muscular fatigue include increases in heart rate, blood pressure, and in the bioelectric activity of the muscles being exerted. For males under laboratory conditions, shifting of weights of from 2-2.5 kg at the assigned rate and performance of 10-12 watts of work gave rise to monotony reactions after sufficient repetition. When the weights increased to 3-3.5 kg and the work performed reached 15-17.5 watts, the signs of monotony increased. With weights of 5-7 kg and 25-35 watts of work demanded, signs of reaction to muscular fatigue began to predominate. Women loading bread, where tempo and weight of load were not fixed, used approximately 1500-1680 calories on their work and performed from 9.2 to 17.7 watts of work per shift. Heart rates of women working on this job tended to reach a certain level in the first hour and then remain stable throughout the shift. The level of this plateau was a function of the amount of weight lifted during the shift and of the total amount of work performed. These physiological signs are characteristic of muscular fatigue and not monotony and indeed exceed the maximum work exertion recommended as ergonomically desirable. In contrast, males working at the same bread loading jobs demonstrated reactions characteristic of monotonous work, as opposed to muscular fatigue when the weight loaded remained below 3 tons per shift and when work performed

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equaled 9 watts or less. Beyond this point, signs of muscular fatigue began to predominate.

Figure Titles: Figure 1: Changes in heart rate in workers loading various weights of bread during the course of an eight hour shift

Figure 2: Decrease in isometric capacity hand muscles over the course of a shift loading bread as a function of amount of work performed

P113(10/85) Rakov GK, Fadeyev YuA. Using galvanic skin response to estimate emotional stress during job performance. *Fiziologiya Cheloveka*. 11(3): 463-469; 1985. [17 references; None in English]
Affiliation: P.K. Anokhin Institute of Normal Physiology; USSR Academy of Medicine, Moscow.

Psychology, Stress, Emotional; Job Performance
Humans, Workers
GSR

Abstract: Twenty factory workers whose job tasks involved press-fitting cathode heaters for picture tubes participated in this study. A job analysis of the tasks they performed revealed three major subtasks varying in difficulty, susceptibility to error, and in the mental resources required for correct performance. Non-polarizing electrodes were attached to the palm and back of each worker's hand and GSR (galvanic skin response) was measured before the beginning of task performance and during the performance of each of the three complex subtasks. It was determined that GSR varied as a function of the mental demands made by the circumstances of task performance (as revealed by job task analysis). GSR was most likely to occur where a job task was delicate and/or and the likelihood of errors necessitating task repetition was high.

Table and Figure Titles: Table 1: Recorded GSR data in workers checking the volume of the barrel of picture tube lenses

Figure 1: GSR before the checking operation

Figure 2: GSR during the checking operation

Figure 3: GSR during a checking operation revealing the need to repeat the previous task

RADIOBIOLOGY
(See also: IMMUNOLOGY: P103)

P114(10/85) Kalacheva VYa, Arente GV, Pavlovskaya TYe. Energy-independent binding of Ca^{2+} ions by mitochondria of pea seedlings and the negative effect of X-rays on this process. Radiobiologiya. XXV(3): 348-35; 1985. [11 references; 9 in English] Affiliation: A.N. Bakh Institute of Biochemistry, USSR Academy of Sciences, Moscow.

Radiobiology, X-rays
Botany, Peas, Mitochondria
Calcium Binding

Abstract: This work is devoted to investigation of energy independent binding of Ca^{2+} ions by the mitochondria of pea seedlings and the mechanism underlying the disruption of this process by radiation. Mitochondria were isolated from 7-8 day old pea (*Pisum sativum*) seedlings and placed in a suspension. This suspension was irradiated with X-rays at doses of 9, 45 and 90 Gy (1 Grey= 100 rad) with a dose rate of 8.5 Gy/min. To investigate energy independent binding the mitochondria were incubated with Ca^{45} and the reactions were then dampened by a surplus of EDTA chelator. Since neither EDTA nor its calcium complexes penetrate the internal mitochondrial membrane, the method allows differentiation between reverse binding of Ca^{2+} by external mitochondria fragments and Ca^{2+} transported into the matrix. Results indicated that the effect of X-irradiation on Ca^{2+} binding depended both on dosage and on time elapsed since irradiation. Radiative inhibition was greater with larger doses and dissipated as time passed. For all radiative doses used, inhibition of Ca^{2+} binding was more pronounced in the less concentrated suspension of mitochondrial protein. Irradiation was shown to decrease the number of binding sites and to alter their affinity for calcium. The authors suggest that disruption of surface binding of ions may play a major role in the radiative inhibition of calcium transport through the mitochondrial membrane.

Table and Figure Titles: Table: Energy independent binding of Ca^{2+} ions by mitochondria as a function of dosage and time elapsed since irradiation

Figure 1: Energy independent binding of Ca^{2+} by control and irradiated (dose=90 Gy) mitochondria of pea seedlings as a function of concentration of calcium in the medium

Figure 2: Scatchard curve for energy independent binding of Ca^{2+} by control and irradiated (dose=90 Gy) mitochondria of pea seedlings

P140(10/85) Chernov IP. The moderating influence of hypokinesia on interphase destruction of thymus and peripheral blood lymphocytes in irradiated rats [Abstract only]. Radiobiologiya. XXV(3): 429; 1985. [No references cited] Affiliation: I.P. Pavlov Medical Institute of Ryazan'

Radiobiology, Lymphocytes

Rats

Hypokinesia

Translation of abstract of paper on file at the All-Union Institute of Scientific and Technical Information.

Abstract: Experiments on male rats irradiated at doses of 0.2, 0.4 and 0.8 Gy during critical periods of hypokinesia revealed fluctuations in radiation tolerance of peripheral blood and thymus lymphocytes. Sensitivity to radiation increased during periods of acute stress and of disadaptation (days 1-3 and 85 of hypokinesia respectively). Fluctuations in radiation tolerance decreased in the period of relative adaptation (day 20 of hypokinesia). Fluctuations in the radiation tolerance of lymphocytes is associated with changes in nonspecific resistance and lymphoid tissue which occur during hypokinesia.

MONOGRAPHS

BIOSPHERICS

M30(10/85) Kaznacheyev VP, editor in chief. Prognoz antropoekologicheskoy situatsii s pomoshch'yu kosmicheskikh sredstv: Materialy Pervogo Vsesoyuznogo soveshchaniya po kosmicheskoy antropoekologii [Predicting anthropoecological situations using data obtained in space: Proceedings of the First All-Union Conference on Space Anthropol ecology], Novosibirsk, 1982. Leningrad: Nauka; 1982. [167 pages; illustrated with tables, diagrams and photographs]

Affiliation: USSR Academy of Sciences, Scientific Council on Biospherics; USSR Academy of Medicine, Siberian Division

Annotation: This collection contains papers devoted to space anthropoecology (i.e., the use of remote sensing data for studying anthropogenic ecological situations) which were presented at the third scientific session of the Coordinating Council of the Siberian Division of the USSR Academy of Sciences, devoted to the problem of "Aerospace study of the natural resources of Siberia and the Far East". This session was jointly sponsored by a number of other organizations within the USSR Academy of Sciences. Conference topics include: criteria for the use of remote sensing data for medical purposes; the development of ecological assessments using space photographs, and the planning of biospherics experiments. The potential for using space photographs to study the natural environment at sites of disease is discussed, along with the methods for using these photographs to divide territory into epidemiologically relevant zones.

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M31(10/85) Kaznacheyev VP, editor-in-chief. Kosmicheskiye issledovaniya antropoekologicheskoy situatsii Sibiri i Dal'nego Vostoka: Materialy Pervogo Vsesoyuznogo soveshchaniya po kosmicheskoy antropoekologii [Use of data obtained in space to study anthropoecological conditions in Siberia and the Far East: Proceedings of the First All-Union Conference on Space Anthropoecology], Novosibirsk, 1982. Leningrad: Nauka; 1982. [95 pages; illustrated with tables, diagrams and photographs]

Affiliation: USSR Academy of Sciences, Scientific Council on Biospherics; USSR Academy of Medicine, Siberian Division

Annotation: The papers in this collection are devoted to various specific problems in space anthropoecology (i.e., use of data obtained in space to study anthropogenic effects on the ecology), which were discussed at the All-Union Conference on Space Anthropoecology. Emphasis is placed upon the analysis of data from space-based studies of the Earth and on the identification of future trends in this area. The relationships among the state of the environment, space factors and public health are specified.

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BODY FLUIDS
(Also Cardiovascular and Respiratory Systems)

M28(10/85) Lebedev AA. Diureтики i krovoobrashcheniye [Diuretics and circulation]. Moscow: Meditsina; 1984. [208 pages; 14 tables; 21 illustrations; 217 references; 77 in English]

Affiliation: Department of Pharmacology, Kuibyshev Institute of Medicine [Author is Department Chairman]

Annotation: This monograph is devoted to the mechanisms underlying the use of diuretics to correct imbalances in fluid-electrolyte exchange which stem from circulatory disorders (e.g., hypertension, edema, and disruption of renal circulation) leading to acute renal insufficiency, . This work is the result of many years of work by the author and the group which he heads devoted to the study of pharmacological regulation of renal functioning. The author presents a number of original hypotheses concerning the relationships between circulation on the one hand and fluid-electrolyte exchange and renal excretion of sodium and fluid on the other. The hormonal mechanisms through which these systems are united, i.e., the renin-angiotensin system and catecholamines, are discussed. Diuretics are viewed as substances which can correct both fluid-electrolyte and circulatory disorders because of the close interconnections between these two systems in both normal and pathological cases. The author cites data relevant to how diuretics achieve their effects and the capacity of some of them to increase permeability of the kidney nephron. He also presents an original taxonomy of diuretics in which classification is based on how diuretic effects are achieved.

This monograph is intended for pharmacologists, pathophysiologists, physicians and therapists.

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CARDIOVASCULAR AND RESPIRATORY SYSTEMS

M33(10/85) Lipovetskiy BM. Funktsional'naya otsenka koronarnogo krovotoka u cheloveka (Methody fiziologicheskikh issledovaniy) [Functional evaluation of coronary circulation in humans (Methods for physiological studies)]. Leningrad: Nauka; 1985. [167 pages; 4 tables; 51 illustrations; 153 references]

Affiliation: Physiology Division, USSR Academy of Sciences (book)

Annotation: This book discusses modern methods of imposing submaximal and threshold physical stress using the treadmill and bicycle ergometer, defines criteria for evaluating the results of these procedures, and proposes diagnostic indicators for identifying inadequate coronary circulation and latent coronary insufficiency. Noninvasive coronary measurements made during physical stress include polycardiography (simultaneous recording of a number of cardiographic indexes), apical cardiography [Translator's note: the meaning of this term is unclear], as well as the EKG. This book analyzes the major types of responses to physical stress tests on the part of healthy individuals and patients with overt and latent ischemic heart disease. Numerous illustrative examples of electrocardiograms, and poly- and apical cardiograms taken under conditions of rest and physical stress are included. This facilitates the interpretation of the results of the functional tests.

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MICROBIOLOGY

(Also Genetics; Also Histology; Also Enzymology)

M27(10/85) Bayev AA, editor. Biotekhnologiya [Biotechnology]. Moscow: Nauka; 1984. [309 pages]

Affiliation: Scientific Council on Problems in Biotechnology,
Institute of Microorganism Biochemistry and Physiology, USSR Academy
of Sciences

Annotation: This book presents an overview of the field of modern biotechnology, its function and its future. The successful development of biology during the last few decades has not only resulted in numerous innovations within the traditional areas of biotechnology, microbiology and biochemistry, but also has engendered new areas for future development, such as genetic and cellular engineering. By providing its own unique solutions to the problems of resources, energy, and the environment, biotechnology is creating a scientific foundation for industry.

This book is intended for a broad range of readers -- biologists, and workers in [applied] microbiology, agriculture, and the food and medical products industries.

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MUSCULOSKELETAL SYSTEM

M32(10/85) Rakhimov YA, editor in chief. Struktura skeletnykh myshts i vysokogornaya gipoksiya [The structure of the skeletal muscles and high-altitude hypoxia]. Novosibirsk: Nauka; 1985. [85+ pages]

Affiliation: Tadzhikistan Academy of Sciences

Annotation: This book addresses the problem of the participation of skeletal muscle in adaptation to high altitude conditions. The major emphasis is on microscopic changes in the vasculature and submicroscopic changes in muscle fibers of various functional types -- including changes in their ultrastructural components -- which occur as part of the adaptive process. Correlational statistics are used to demonstrate certain associations between structures and functional changes at various levels of the body. This book is intended for biologists (morphologists and physiologists) and specialists in physical culture and athletics.

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SPACE PHYSIOLOGY

M29(10/85) Gasanov GG, editor in chief. XIV S'yezd vsesoyuznogo fiziologicheskogo obshchestva imeni I.P. Pavlov [(Proceedings of) the] XIVth Conference of the I.P. Pavlov All-Union Physiological Society]; 1983; Baku. Leningrad: Nauka; 1983. 2 vol. [487 and 467 pages].

These volumes contain abstracts of papers delivered at the 1983 Conference of the I.P. Pavlov All-Union Physiological Society. Abstracts range from 1/2 page to 2-3 pages. The titles, authors, affiliations where available, and page numbers of the abstracts most relevant to NASA's life science interests are cited below.

VOLUME 1

Problems and achievements in physiological cybernetics. Kogan AB, Shidlovskiy VA. Scientific Research Institute of Neurocybernetics, Rostov-na-Donu; Central Institute for Physician Training. (5)

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Interrelationship between physical and mental work under conditions of different oxygen partial pressures. Sapova AI, Pavlova TA, Leningrad. (317)

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The effect of oscillations in solar factors on circadian rhythms. Moyseyeva NI, Lyubitskiy RYe. Scientific Research Institute for Experimental Medicine, USSR Academy of Medicine, Leningrad. (364)

Fatigue in women performing physical labor. Vasilevskaya KV, Vetokhina GA, Gershbaum PS, Yosifova VA. Byelorussian Scientific Research Institute for Sanitation and Hygiene, Minsk. (373)

The mechanisms of postural control. Smetanin BN, Alekseyev MA. Institute for Problems in Information Transmission, USSR Academy of Sciences, Moscow. (399)

BOOK REVIEWS

EXOBIOLOGY

BR3(10/85) Korochkin LA. Review of: Kordyum VA, *Evolutsia i Biosfera*. Kiev: Naukova Dumka; 1982. In: *Zhurnal Evolutsionnoy Biokhimii i Fiziologii*. XXI(3): 319-321; 1985.

Translation: V.A. Kordyum's book is devoted to discussion of controversial issues in modern evolutionary theory, particularly to the analysis of its molecular aspects. This book is noteworthy for its unbiased, dogma-free approach to the vast amount of material relevant to this subject, a rare characteristic in works of this type.

There has long been need for such a review. This is particularly true today, when many individual postulates of evolutionary theory which have been accepted without question for many years, must be reassessed in light of recent discoveries, especially in the area of molecular biology (Cf. also: Vorontsov NN. The synthetic theory of evolution: its sources, major postulates and unsolved problems. *Zhurnal Vsesoyuznogo Obshchestva Khimii imeni D.I. Mendeleeva*. 25(3): 295-314; 1980).

This book contains an introduction, 10 chapters, and a conclusion. Chapters 1 and 2 are devoted to a description and critical discussion of the major tenets of the synthetic theory of evolution, which is based on a synthesis of Darwinism and population genetics. It is assumed that the process of natural selection described by Charles Darwin, is a product of chance genetic mutations and thus is random in nature and occurs slowly by means of gradual accumulation of imperceptible genetic deviations.

The author believes that there is one major point which must not be overlooked -- the organism falls far short of accepting every possible molecular change in protein structure. "There exist certain well-defined permissible zones, within which changes in the code lead to consequences which are not eliminated by evolution" (p.23).

The probability of the random appearance of even one molecular trait is extremely small. Thus, according to the author's calculations, the probability of a new enzyme forming as a result of random events is on the order of 10^{-11} . The author quotes L.S. Berg: "The probability that all the useful variations will arise randomly and simultaneously in all parts, is the probability of a miracle" (p. 24).

In the course of a rather detailed discussion of the difficulties of attributing the appearance of new traits to the results of natural selection, the author takes issue with the established approach, which derives macroevolutionary events from microevolutionary ones. In conclusion, he cites R. Leontin, one of the authorities on synthetic evolution. After analyzing various computations of selectivity level, selection pressure, rate at which one form replaces another under selection, he[referent ambiguous] writes, "If the reader has begun to feel that there is nothing in these proofs but arbitrary juggling of figures, which can be selected in such a way as to confirm any

biased point of view, then I have achieved my goal" (p. 31).

Chapters 3 and 4 are specifically devoted to phenomena which are difficult to explain from the perspective of synthetic evolution. This theme is expressed in the chapter titles: "Life outside the laws" and the "The generality and paradoxes of the living." In my opinion this is the best part of the book, written in a lively and interesting manner, with reference to classical material, as well as to modern molecular data. The author, for example, lists certain adaptations which standard theories, based on chains of small gradual transformations, fail to explain. Examples of such adaptations are the eye of the vertebrate, the phosphorescent organs of the cephalopod with a mirror-lens and reflecting layer, and joints. "There is no way that mutation followed by selection could lead to such adaptations, which are not needed by the organism at the level at which they appear" (p. 42).

The author considers the exceptional stability of certain species to be significant. Paleontological observations have revealed that many forms have remained unchanged since the Cambrian era. For example, he poses the question of how it is possible to explain the fact that certain sponges contain fluoride in concentrations of up to 11.5% dry weight, while the fluoride concentration in their environment does not exceed 1.3 mg/ml.

The author also points out that, while there are basic processes and molecular systems shared by all living organisms, there also exist certain strange resemblances in individual traits which cannot be explained by reference to phylogenetic relationships. For example, the enzyme of lysozyme is characteristic of certain bacteriophages, plants, insects and vertebrates. The lysozyme of certain Lepidoptera has a primary amino acid sequence close to that found in chickens. Hemoglobin has been found in yeast, insects, and in plants (tissues of leguminous tubers). The hormone of molting insects, ecdysone, is synthesized not only by insects, but also by plants and fungi. There are many such examples (pp. 62-63). and the author questions how the development of such affinities can be explained by the operation of natural selection.

In the fifth chapter, the author considers the possibility that certain molecular and genetic mechanisms (transformation, transduction, symbiogenesis, transgenosis, etc.) could participate in the process of evolution. At one point, it must be admitted, his zeal overreaches his credibility: little convincing evidence exists to support his hypothesis of a viral role in normal embryogenesis. This chapter ends with a table containing examples of the conversion and inheritance of traits in prokaryotes which have been introduced by external agents.

In the sixth chapter the author develops his own model of the process of evolution, which he calls an information model. He starts from the following postulates: "1) the quantity and quality of DNA in various closely related taxa and organisms is not constant; 2) the total genome consists of a portion representing what has been realized in the phenotype and a portion composed of DNA which has not yet been

realized in the phenotype, i.e., which is still "silent" and thus quantitatively and qualitatively variable; 3) there must exist a mechanism by which exogenous heritable material is incorporated in the genome and eliminated from the genome, i.e., the elimination of the silent DNA; 4) the quantity of silent DNA in the genotype, and thus the mechanism for incorporating and eliminating material, must have an effect on the evolution of the given taxon; 5) to the extent that there exist specialized systems for transmitting information, the genome must retain some degree of modularity, since it is not a monolithic, but a composite structure" (p. 123).

The author also points out the curious fact that no one has ever discovered any sort of regular correlates of fluctuations in the level of DNA in any stage in the course of evolution. "Representatives of substantially more advanced taxons can carry several times less DNA in their cells than representatives of simpler and evolutionarily earlier taxons. And this is not an exceptional case, but a very frequent one.... [Furthermore] the amount of DNA carried by one species may be several times greater than that carried by another closely related species. This is, evidently, true for all groups of living creatures" (p. 123).

It is also of interest that the heterogeneity of genetic material expressed by DNA, discovered by molecular biologists through the use of DNA hybridization, manifests a certain amount of species specificity, so that interspecies differences are attributable not only to repeating sequences, but also to unique sequences.

The discussion of the problem of the species in Chapter 7 proceeds logically from the previous chapters. The author examines the various definitions of species in the literature (pp. 172-175) and evidently, is inclined to consider the most important aspect of any viable definition to be lack of crossbreeding, i.e., reproductive isolation, as a criterion for defining species as different. This is difficult to dispute, as is the significance of chromosomal rearrangement for reproductive isolation. However, the importance the author ascribes to various free translocations of the mobile components of the genome seems exaggerated and the propositions he derives from this assumption are questionable. Nevertheless, these represent the crux of the author's hypothesis, implicit throughout the book, but formulated explicitly only in Chapters 8-10. The author believes that exogenous information, included in DNA fragments, which has been introduced into the cell by various means (transformation, transduction, etc.), is constantly being "pumped" through the genetic material. Phenotypical correlates generated by new DNA combinations undergo a kind of "endurance test." "As a common store of information has accumulated in the biosphere and exchange of information has expanded (due to the continual development of new information channels), the rate of evolution has continuously accelerated and its manifestations have become increasingly heterogeneous." (p. 203)

The author's hypothesis is quite speculative, yet one of its implications is consistent with the views of V.I. Vernadskiy, (who is, unfortunately, not quoted in the book) and with the increasingly popular so-called "Gay hypothesis" (which is also not mentioned

explicitly), the process of evolution can only be comprehended through analysis of the biosphere as a whole. V.A. Kordyum calls for the undertaking of such an analysis and it is impossible to disagree with him. Kordyum, by the way, avoids citing his own works which, in a number of instances, would have been appropriate.

At the same time it is difficult to ignore the exaggerated importance he ascribes to the so-called "silent" DNA, which was postulated during the 1960s by Zuckerkandl and Pauling. Indeed, the data concerning the molecular genetics of development testify that genes which are capable of transcription account almost totally for ontogeny. The additional inclusion through mutation of some sort of a pseudogene (heretofore "silent" because of a structural incapacity for transcription), would scarcely lead to any noticeable effect on the evolutionary output.

Despite the shortcomings noted above and the presence of irritating typographical errors, the book "Evolution and the Biosphere," would be extremely useful for molecular biologists interested in problems of evolution, as well as for a broad range of readers wishing to acquaint themselves with contemporary concepts of evolution. Unlike the authors of many specialized textbooks in this area, the author does not sidestep difficulties and complex problems, but states them clearly and, (obviously recognizing the limitations of generally accepted concepts and the impossibility of using them to explain new data, especially in molecular biology), attempts to find some new approaches. Such an attempt should be encouraged.

BODY FLUIDS

BR4(10/85) Leybson L. Review of: Natochin YuV. Problemy evolyutsionnoy fiziologii vodno-solenogo obmena. [Problems in the evolutionary physiology of fluid-electrolyte exchange]. Leningrad: Nauka; 1984; 34 p. In: Zhurnal Evolyutsionnoy Biokhimii i Fiziologii. XXI(2): 210-212. [An abstract of this monograph appeared in the second issue of the 1985 Digest.]

Translation: The pamphlet reviewed here was delivered as the Fourth Orbeli lecture by the winner of the prize of the same name, Yu.V. Notochina, at the scientific conference commemorating the centennial of Orbeli's birth. In this lecture Yu. V. Natochin has presented a succinct discussion of all the major problems of fluid-electrolyte exchange in evolutionary physiology.

In the introduction the author explains the significance of the development of a special system to support fluid-electrolyte equilibrium has for the evolution of life. Because of this system, such important physical chemical parameters as ion composition, fluid volume, and concentration of hydrogen ions, are maintained at a constant level. Without this capability, progressive development of the organism's functions, particularly in the nervous system, would not have been possible. How did the system regulating fluid-electrolyte exchange develop in the course of evolution? What factors influenced its development? What was the role of the development of this system in the evolution of life? These are the questions Yu. V. Natochin addresses in his lecture. It is not difficult to see that these topics reflect the essence of the two aspects of L.A. Orbeli's evolutionary theory -- the evolution of functions and functional evolution. In accordance with this division within Orbeli's theory, the pamphlet is subdivided into two major sections: "Some issues relating to the evolution of fluid-electrolyte exchange and the kidneys" and "Functional evolution." The pamphlet also contains an additional section entitled "Relation between theory and practice in the evolutionary physiology of fluid-electrolyte exchange."

In the first section, the author considers the evolution of the functions of the major fluid-electrolyte exchange organ - the kidneys. He expresses the important idea that the evolution of the functions of any organ are associated with changes at three levels: its structure as an organ, the structure of the elementary units of which it is composed and the restructuring of the whole system to which the given organ belongs. The evolution of the kidney as an organ essentially follows principles similar to those which have been found to govern the evolutionary development of other organs. These principles are: the growth of polyfunctionality of the organ; further development of the processes which support its functioning; the superstructure principle; oligomerization of organs and polymerization of its functional units; replacement of functions; substitution of the organ or its functions; and irreversibility of regressive evolution. Yu. V. Natochin illustrates all of these principles as they apply to the kidneys with facts, many of which were discovered by him and his co-workers, or by his teacher A.G. Ginetsinskiy.

It is appropriate here to raise a terminological issue. V.A. Dogel' defines "oligomerization" as the phenomenon of decrease of the number of homological organs fulfilling an identical function over the course of evolution. However, as a rule, this decrease takes place by the merging and coalescence of separate organs into a larger organ. Sometimes this new larger organ consists of elementary units, performing similar functions but differing in embryological origin. For example, the kidneys of mammals consist of a large number of nephridia, which are similar in function to the numerous nephridia of the lower animals although they are of different origin. Many authors, including Yu.V. Natochin, call the process in both these cases "polymerization." Thus, oligomerization occurs through polymerization. This is very unfortunate terminology, additionally so, because these terms have long been used in chemistry to convey other meanings. In my work on the evolution of endocrine functions I have called this biological phenomenon "concentration or consolidation of organs" (Zhurn. evol. biokhim. i fiziol. 1967(3): 532-544. Evolutsionnaya fiziologiya, Leningrad: Nauka; 1984; part 2, page 47).

The evolution of nephrons, the elementary units composing the kidney, follows other principles. First, differentiation increases. Thus, in the mammalian kidney the narrow portion of Henle's loop is more differentiated. The distal tubule also consists of several portions which serve different functions and react differently to hormones. Second, in the nephron cells there is an increased number of organelles, for example, the mitochondria. Thus, there is a greater number of mitochondria in the cells of the proximal tubule in mammals than in the corresponding structure of lower vertebrates. In addition, the amount of folding in the basal membrane increases. This leads to a sharp growth in its surface area. As a result of these two processes occurring in the elementary structural units of the kidneys, renal effectiveness increases without a corresponding increase in renal size. Again, Yu.V. Natochin uses the term "polymerization" to refer to the increase in the number of mitochondria in the cell. However, these mitochondria do not unite to form a larger unit -- their number simply increases. Why not simply describe the process in precisely these terms?

Over the course of evolution, along with changes in the structure and functions of the kidney as a whole and its elementary components, there have also been global changes in the entire functional system which maintains fluid-electrolyte balance. This phenomenon is evidenced by the considerable increase in the complexity of the regulatory mechanisms involved. For example, in higher vertebrates calcium balance is maintained by three humoral factors -- calcitonin, parathyroid hormone, and an active form of vitamin D₃; while in fish similar regulation is controlled only by calcitonin. The sensitivity of the kidney to hormones also changes. In mammals the prostaglandins regulate sensitivity of the kidney to vasopressin. This also increases the efficiency and accuracy of the system.

As mentioned above, another aspect of the evolution of the physiological system for regulating fluid-electrolyte exchange is functional evolution. The first question which arises involves specifying the initial determinants of the structure of this system

and the changes it underwent in the course of evolution. The author believes that the molecular and cellular mechanisms participating in all the osmoregulatory systems developed over hundreds of millions of years of precellular evolution. These mechanisms led to passive transport of water along an osmotic gradient and active transport of sodium by means of a sodium pump. During further evolution these mechanisms were incorporated into various specialized cells and membranes. The sodium transport mechanism is of critical significance for osmoregulatory cells. In animals at various evolutionary levels, uropoiesis occurs as a two stage process, which consists of ultrafiltration of the blood (or hemolymph), followed by reabsorption of substances necessary to the organism. An analogous process is used not only for excretion of urine, but also for the formation of other secretions: saliva, perspiration, milk, etc. Evolutionary paths are limited and nature must choose those which agree with general laws of physics and chemistry.

Finally, Yu.V. Natochin emphasizes that it is the organism as a whole which is evolving, and that it is not possible to consider the evolution of one system apart from the associated changes in other functional systems. Thus, the growing effectiveness of the mammalian kidney, the almost hundredfold increase in its blood supply in comparison to that of lower vertebrates would have been impossible without progressive development of the circulatory and respiratory systems, the development of thermal homeostasis, or the transformation of the nervous and endocrine systems. The study of the interrelationships among the various functional systems and their historical development is one of the most important tasks of evolutionary physiology. Without an understanding of these interrelationships, we could not understand how the organism adapts to changing conditions in the environment. We could not understand the origin of man.

In the final portion of this pamphlet, the author demonstrate how an understanding of the evolutionary physiology of fluid-electrolyte balance has led to practical applications. He cites convincing examples of the use of results obtained in this discipline for solving practical problems in the fishing industry, (medical) nephrology, and space medicine.

In conclusion, it is appropriate to repeat what was said above: Yu.V. Natochin's lecture, as published in this pamphlet, represents an excellent and clear discussion of the problems of evolutionary physiology as applied to several areas of great importance. The terminological issues I have raised do not diminish my positive assessment of this pamphlet. Because of its brevity, the clarity of its presentation, and the expertise of its author, this pamphlet will certainly be of interest and benefit to readers working in various areas of biology and medicine.

CURRENT TRANSLATED SOVIET LIFE SCIENCE MATERIALS AVAILABLE TO OUR
READERS

Translations of recent Soviet publication, including those of interest to specialists in space life sciences, are published by Joint Publications Research Service (JPRS). JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The phone number of NTIS is (703)-487-4600 and telephone orders are encouraged. Each individual issue of a JPRS report must be ordered separately. Prices depend on number of pages; the most recent issue of Space Biology and Aerospace Medicine, for example, costs \$16.00. However, prices are expected to go up on 1 October. When ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited. An order takes 9-30 days to arrive. Rush orders are possible but involve an additional charge. There is a significant and variable lag period between the time a JPRS publication is completed and the time it is orderable from NTIS.

Two JPRS USSR Report Series appear of particular interest to NASA life scientists. These are: 1) Space, and 2) Life Sciences: Biomedical and Behavioral Sciences. In addition, JPRS translates the entire issue of the bimonthly Space Biology and Aerospace Medicine. As a service to our readers we will regularly provide publication information for these reports and cite the titles of articles selected as of particularly relevant to NASA. Translations of titles are those of JPRS. JPRS entries marked with * were previously abstracted in this Digest.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE
[KOSMICHESKAYA BIOLOGIYA I AVIAKOSMICHESKAYA MEDITSINA]
TRANSLATION OF ENTIRE JOURNAL

Vol.19, No. 2, March-April 1985

JPRS-USB-85-004 12 August 1985

* Abstracts for this issue appeared in the first (August; No. 1) issue of the USSR Space Life Sciences Digest.

Vol.19, No. 3, May-June 1985
JPRS-USB-85-005 14 August 1985

* Abstracts for this issue appeared in the second (October; No. 2) issue of the USSR Space Life Sciences Digest.

USSR REPORT ON LIFE SCIENCES BIOMEDICAL AND BEHAVIORAL SCIENCES

JPRS-UBB-85-020, 25 JULY 1985

Selected Contents:

Remote Medical Diagnosis
(Newspaper Article; 2 pages)

Hydroponics Developments for Spaceship Garden
(Journal Abstract; Meshkov Yu; 1 page)

Quantitative Criteria of Evaluating State of Functional System
Responsible for Gaseous Homeostasis
(Journal Abstract; Metelev VV; 1 page)

Telephonic Cardiac Diagnostics
(Newspaper Article; 1 page)

Effect of Cellular Respiration Inhibitors on Formation of Structural
Mutations in Human Lymphocytes, Irradiated at Various Stages of
Mitotic Cycle
(Journal Abstract; Luchnik NV, Poryadkova NA, et al.; 1 page)

Immediate Effects of Rat Gamma-Irradiation on Lipid Transport
Function of Hepatocyte Cytosol
(Journal Abstract; Kolomiytseva IK, Potekhina NI, et al.; 1 page)

Parameter Evaluation of Probability Model of Radiation Cell
Inactivation from Survival Plots
(Journal Abstract; Amirtayev KG, Korogodin VI, et al., 1 page)

Radioprotective Effects of Acute Hypoxia in Neutron-Irradiated Dogs
(Journal Abstract; Kalmykova GI, Nikanarova NG, et al.; page 1)

Effects of Pretreatment with Chronic Irradiation and alpha-Tocopherol
on Gamma-Ray Induced Chromosomal Aberrations in Mouse Bone Marrow
(Journal Abstract; Aliyev AA, Akhundov VYu, et al.; 1 page)

Radiation Mutagenesis under Action of DNA Synthesis Inhibitor
(Journal Astract; Serbiyevskaya SP, Dubinina LG, et al.; 1 page)

USSR REPORT ON LIFE SCIENCES BIOMEDICAL AND BEHAVIORAL SCIENCES

JPRS-UBB-85-022, 21 AUGUST 1985

Selected Contents:

Adaptation to Arctic Life
(Journal Abstract; Vasilyev A; 1 page)

Active Oculography as Diagnostic Method of Human Psychophysiological
State
(Journal Abstract; Volkov VG, Mashkova VM; 1 page)

Operational Method of Monitoring Human Working Capacity
(Journal Abstract; Gosudarev NA, Stavitskiy KR; 1 page)

Evaluation of Occupational Efficiency of Display Terminal Operators
(Journal Abstract; Martynikhin AV, Polyakov IV, et al.; 1 page)

Laboratory Manuals for Engineering and Work Psychology
(Journal Abstract; Denisov VA; 1 page)

Effects of Immunocompetent Cells on Acclimatization to Hot Climate
(Journal Abstract; Khudaybergenov MA, Mamedov KhM; 1 page)

Effect of Extreme Factors and Adaptation to Alpine Conditions on
Indicators of Peroxide Oxidation of Blood Serum Lipids
(Journal Abstract; Sutkovoy DA, Baraboy VA; 1 page)

Studies on EEG and EMG Indicators of Perception and Possible
Information Transfer from Stage 2 to REM Sleep
(Journal Abstract, Arons YeK, Vasil'yeva VM, et al.; 1 page)

*Spontaneous Changes of Emotional State Under Conditions of Monotony
and Decasecond Rhythms of Brain Potentials
(Journal Abstract; Aladzhlova NA, Kvasovets SV; 1 page)

Soviet-French Group Plans Cooperation in Space Cytology
(Newspaper Article Excerpt; 1 page)

TITLES AND ENGLISH AVAILABILITY OF MONOGRAPHS IN THE SOVIET SERIES
"PROBLEMS IN SPACE BIOLOGY"

In response to a suggestion from one of our readers, we are publishing a partial list of titles in the Soviet monograph series: Problemy Kozmicheskoy Biologii [Problems in Space Biology]. NASA translations of many monographs in this series are available through NTIS. For these volumes we will cite numbers necessary for ordering and price. We will also cite NASA's translation of the titles to avoid confusion in ordering. General information about ordering from NTIS appears at the beginning of the JPRS listings. Volumes marked with a * were abstracted in the first issue of this Digest. We will attempt to provide information about the missing volumes in this series, 1-4, 29-32, 34, 35 and 37, in the next issue of the Digest.

Volume 5: Moskalenko YuYe. Krovenapolneniya golovnogo mozga v norme i pri gravitatsionnykh nagruzkakh [Dynamics of the cerebral blood volume under normal conditions and gravitational stresses]. Leningrad: Nauka; 1967. 193 pages; price not given. NASA-TT-F-492; Accession #: 68N15477.

Volume 6: Sisakyan NM. Russian title not cited. Gravitational and acceleration effects on man and organisms and biological effects of radiation. Moscow: Nauka; 1967. 528 pages; price not given. NASA-TT-F-528. Accession #: 69N38701.

Volume 7: Chernigovskiy VN. Rabochaya Deyatel'nost. Voprosy Obityayemosti i Biotekhnologii [Operational activity, problems of habitability and biotechnology]. Moscow: Nauka; 1967. 527 pages; price not given. NASA-TT-F-529. Accession #: 69N32044.

Volume 8: Chernigovskiy VN. Russian title not cited. Adaptation to hypoxia and resistance of an organism. Moscow: Nauka; 1968. 255 pages; Selected sections; price not given. NASA-TT-F-580. Accession #: 69N32131.

Volume 9: Saksonov PP, Antipov VV, Davydov BI. Ocherki kosmicheskoy Radiobiologii [Outline of space radiobiology]. Moscow: Nauka; 1968. 616 pages; \$9.00. NASA-TT-F-604. Accession #: 72N20039.

Volume 10: Razumeyev AN. Nerunyye mekhanizmy vestibulyarnykh reaktsiy [Nerve mechanisms of vestibular reactions]. Moscow: Nauka; 1969. 336 pages; price not given. NASA-TT-F-605. Accession #: 71N10393.

Volume 11: Kustov VV. Toksikologiya produktov zhiznedeyatel'nosti i ikh znacheniye v formirovaniy iskusstvennoy atmosfery germetizirovannykh pomescheniy [The toxicology of products of vital activity and their importance in the formation of artificial atmospheres of hermetically sealed chambers]. Moscow: Nauka; 1969. 156 pages; Selected section; price not cited. NASA-TT-F-634. Accession #: 71N20493.

Volume 12: Vinnikov YA, Gazenko OG, et al. Retseptor gravitatsii. Evolutsiya Strukturnykh, Tsitokhimicheskikh i Funktsionalnykh Organizatsii [The gravity receptor: Evolution of the structural, cytochemical and functional organization]. Leningrad: Nauka; 1971. 600 pages; \$6.00. NASA-TT-F-720. Accession #: 73N20128.

Volume 13: Genin AM. Dlitel'noye organicheniye podvizhnosti i yego vliyaniye na organism cheloveka [Prolonged limitation of mobility and its influence on the human organism]. Moscow: Nauka; 1969. 271 pages; price not given. NASA-TT-F-639. Accession #: 70N2851.

Volume 14: Saksonov PP, Davydov BI. Radiobiologicheskikh aspekty reaktivnosti organizma v svyazi s kosmicheskimi poletami [Radiobiological aspects of the reactivity of the organism during space flights]. Moscow: Nauka; 1971. 664 pages; \$9.00. NASA-TT-F-721. Accession #: 73N20054.

Volume 15: Kotovskiy YF, Shimkevich LL, Vasilyev PV. Funktsionalnaya morfologiya pri ekstremal'nykh vozdeystviyakh [Functional morphology during extremal actions]. Moscow: Nauka; 1971. 488 pages; \$6.00. NASA-TT-F-738. Accession #: 73N19126.

Volume 16: Chenigovskiy VN. Russian title not cited. Medical and biological problems of manned space flight. Moscow: Nauka; 1971. 427 pages; \$6.00. NASA-TT-F-719. Accession #: 73N19077.

Volume 17: Vasilyev PV, Belay VY, Glod GD, Razumeyev AN. Patofiziologicheskiye osnovy aviatsionnoy i kosmicheskoy farmakologii [Pathophysiological bases of aviation and space pharmacology]. Moscow: Nauka; 1971. 514 pages; \$6.00. NASA-TT-F-736. Accession #: 73N22033.

Volume 18: Chenigorvskiy VN. Vliyaniye nekotorykh kosmicheskikh i geofizicheskikh faktorov na biosfery Zemli [The effect of certain space and geophysical factors on the biosphere of the Earth]. Moscow: Nauka; 1973. 245 pages; \$14.50. NASA-TT-F-15158. Accession #: 74N16050.

Volume 19: Tarusov BN. Problemy ustoychivosti biologicheskikh sistem [Problems of the resistance of biological systems]. Moscow: Nauka; 1971. 284 pages; \$6.50. NASA-TT-F-761. Accession #: 74N13779.

Volume 20: Svirezhev YM, Yelizarov YY. Matematicheskoye modelirovaniye biologicheskikh sistem [Mathematical models of biological systems]. Moscow: Nauka; 1972. 185 pages; \$5.25. NASA-TT-F-780. Accession #: 74N14823.

Volume 21: Kovalenko YA, Chernyakov IN. Kislorod tkaney pri ekstremal'nykh faktorakh poleta [Tissue oxygen under extreme flight factors]. Moscow: Nauka; 1972. 264 pages; \$6.35. NASA-TT-F-762. Accession #: 73N30065.

Volume 22: Balakhovskiy IS, Natochin YV. Obmen veshchestv v ekstremalnykh usloviya kosmicheskogo poleta i pri yego imitatsii [Metabolism under the extreme conditons of spaceflight and during its simulation]. Moscow: Nauka; 1968[?]. 195 pages; \$11.75. NASA-TT-F-15163. Accession #: 74N13813.

Volume 24: Chizhov SV, Sinyak YY. Vodoobespecheniye ekipazhey kosmicheskikh korabley [The water supply of spacecraft crews]. Moscow: Nauka; 1973. 262 pages; \$16.25. NASA-TT-F-15164. Accession #: 74N18795.

Volume 25: Gramenitskiy PM. Dekompressionnyye rastroystva [Decompression disorders]. Moscow: Nauka; 1974. 356 pages; \$10.00. NASA-TT-F-15970. Accession #: 75N13518.

Volume 26: Voskresenskiy AD, Venttsel MD. Statisticheskii analiz serdechnogo ritma i pokazateley gemodinamiki v fiziologicheskikh issledovaniyakh [Statistical analysis of the cardiac rhythm and hemodynamic indices in physiological research]. Moscow: Nauka; 1974. 234 pages; \$7.50. NASA-TT-F-16196. Accession #: 75N24324.

Volume 27: Ivanov VI. Radiobiologiya i genetika Arabidopsisa [Radiobiology and genetics of Arabidopsis]. Moscow: Nauka; 1974. 192 pages; \$7.00. NASA-TT-F-15849. Accession #: 75N10679.

Volume 28: Gitelson II, Kovorov BG, et al. Eksperimental'nyye ekologicheskkiye sistemy vklyushchiye cheloveka [Experimental ecological systems including man]. Moscow: Nauka; 1975. 351 pages; \$10.50. NASA-TT-F-16993. Accession #: 76N30812.

Volume 33: Dubinin NP. Gravitatsiya i organizm [Gravity and the body]. Moscow: Nauka; 1976. 309 pages; price not given. NASA-TT-F-17526. Accession #: 77N24757.

Volume 50: Levashov MM. Nistagmometriya v otsenka sostoyaniya vestibulyarnoy funktsii [Nystagmometry for evaluation of the status of the vestibular function]. Leningrad: Nauka; 1984. 246 pages; price not given. NASA-TM-77616. Accession #: 85N24694.*

The following recent volumes in the Soviet series "Problems of Space Biology" are not covered by copyright agreements and NASA translations are not available to the public through NTIS. In the full Russian citation, each volume title is preceded by the series name "Problemy Kosmicheskoy Biologii," followed by volume number (e.g., "Tom /Tom=volume/ 23) and volume title.

Volume 23: Stepanova SI. Aktualnyye problemy kosmicheskoy bioritmologii [Current problems in space biorhythmology]. Moscow: Nauka; 1977; 312 pages.

Volume 36: Morozov GI. Teoreticheskiye osnovy proyetrovaniya sistem zhizneobespecheniya [Theoretical foundations of life-support system design]. Moscow: Nauka; 1977; 103 pages.

Volume 38: Azhayev AN. Fiziologo-gigiyenicheskiye aspekty deystviya vysokikh i nizkikh temperatur [Physiological and hygienic aspects of the effects of high and low temperatures]. Moscow: Nauka; 1979; 261 pages.

Volume 39: Vandyshev GI, Yakhontov BO, et al. Deystviye giperbaricheskoy sredy na organizm cheloveka i zhivotnykh [The effects of a hyperbaric environment on the human and animal bodies]. Moscow: Nauka; 1980; 259 pages.

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1. Report No. NASA CR-3922(03)		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle USSR Space Life Sciences Digest - Issue 3				5. Report Date December 1985	
				6. Performing Organization Code	
7. Author(s) Lydia Razran Hooke, Mike Radtke, Victoria Garshnek, Joseph E. Rowe, and Ronald Teeter, Editors				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address Management and Technical Services Company (MATSCO) 600 Maryland Avenue SW Suite 209, West Wing Washington, DC 20024				11. Contract or Grant No. NASW-3676	
				13. Type of Report and Period Covered Contractor Report	
12. Sponsoring Agency Name and Address Office of Space Science and Applications National Aeronautics and Space Administration Washington, DC 20546				14. Sponsoring Agency Code EBM	
15. Supplementary Notes					
16. Abstract This is the third issue of NASA's USSR Space Life Sciences Digest. Abstracts are included for 46 Soviet periodical articles in 20 areas of aerospace medicine and space biology and published in Russian during the second third of 1985. Selected articles are illustrated with figures and tables from the original. In addition, translated introductions and tables of contents for seven Russian books on six topics related to NASA's life science concerns are presented. Areas covered are adaptation, biospherics, body fluids, botany, cardiovascular and respiratory systems, endocrinology, exobiology, gravitational biology, habitability and environmental effects, health and medical treatment, immunology, life support systems, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, perception, personnel selection, psychology, radiobiology, and space physiology. Two book reviews translated from the Russian are included and lists of additional relevant titles available in English with pertinent ordering information are given.					
17. Key Words (Suggested by Author(s)) space life sciences aerospace medicine space biology USSR space flight simulations space flight experiments				18. Distribution Statement Unclassified - Unlimited Subject Category 51	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 104	22. Price A06		

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